

NAFTILOS' NAUTICAL TABLES

**ΠΙΝΑΚΕΣ ΚΑΙ ΥΠΟΛΟΓΙΣΜΟΙ ΝΑΥΤΙΛΙΑΣ
ΕΚΔΟΣΙΣ ΟΓΔΟΗ**

Συγγραφεύς Ν. Χ. ΚΡΟΝΤΗΡΗΣ

**Εκδοσις Γ. ΔΕΜΕΡΟΥΤΗΣ ΠΛΟΙΑΡΧΟΣ Ε.Ν.
Σπ. Ζερβού 21 - Τηλ. 4813940 - Ν. ΦΑΛΗΡΟΝ
ΠΕΙΡΑΙΕΥΣ**

1982

1

Logarithms of Trigonometric Functions

0° →	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos +179°
↓	↓		↓	↓		↓	↓		↓
0	∞	—	∞	∞	—	∞	10.00000	0.	10.00000 60
1	6.46373	30103	13.53627	6.46373	30103	13.53627	.00000	0	.00000 59
2	.76476	17609	.23524	.76476	17609	.23524	.00000	0	.00000 58
3	6.94085	12494	13.05915	6.94085	12494	13.05915	.00000	0	.00000 57
4	7.06579	9691	12.93421	7.06579	9691	12.93421	.00000	0	.00000 56
5	7.16270	7918	12.83730	7.16270	7918	12.83730	10.00000	0	10.00000 55
6	.24188	6694	.75812	.24188	6694	.75812	.00000	0	.00000 54
7	.30882	5800	.69118	.30882	5800	.69118	.00000	0	.00000 53
8	.36682	5115	.63318	.36682	5115	.63318	.00000	0	.00000 52
9	.41797	4576	.58203	.41797	4576	.58203	.00000	0	.00000 51
10	7.46373	4139	12.53627	7.46373	4139	12.53627	10.00000	0	10.00000 50
11	.50512	3779	.49488	.50512	3779	.49488	.00000	0	.00000 49
12	.54291	3476	.45709	.54291	3476	.45709	.00000	0	.00000 48
13	.57767	3218	.42233	.57767	3219	.42233	.00000	0	.00000 47
14	.60985	2997	.39015	.60986	2996	.39014	.00000	0	.00000 46
15	7.63982	2802	12.36018	7.63982	2803	12.36018	10.00000	0	10.00000 45
16	.66784	2633	.33216	.66785	2633	.33215	.00000	1	10.00000 44
17	.69417	2483	.30583	.69418	2482	.30582	.00001	0	9.99999 43
18	.71900	2348	.28100	.71900	2348	.28100	.00001	0	9.99999 42
19	.74248	2227	.25752	.74248	2228	.25752	.00001	0	9.99999 41
20	7.76475	2119	12.23525	7.76476	2119	12.23524	10.00001	0	9.99999 40
21	.78594	2021	.21406	.78595	2020	.21405	.00001	0	9.99999 39
22	.80615	1930	.19385	.80615	1931	.19385	.00001	0	9.99999 38
23	.82545	1848	.17455	.82546	1848	.17454	.00001	0	9.99999 37
24	.84393	1773	.15607	.84394	1773	.15606	.00001	0	9.99999 36
25	7.86166	1704	12.13834	7.86167	1704	12.13833	10.00001	0	9.99999 35
26	.87870	1639	.12130	.87871	1639	.12129	.00001	0	9.99999 34
27	.89509	1579	.10491	.89510	1579	.10490	.00001	0	9.99999 33
28	.91088	1524	.08912	.91089	1524	.08911	.00001	1	9.99999 32
29	.92612	1472	.07388	.92613	1473	.07387	.00002	0	9.99998 31
30	7.94084	1424	12.05916	7.94086	1424	12.05914	10.00002	0	9.99998 30
31	.95508	1379	.04492	.95510	1379	.04490	.00002	0	9.99998 29
32	.96887	1336	.03113	.96889	1336	.03111	.00002	0	9.99998 28
33	.98223	1297	.01777	.98225	1297	.01775	.00002	0	9.99998 27
34	7.99520	1259	12.00480	7.99522	1259	12.00478	10.00002	0	9.99998 26
35	8.00779	1223	11.99221	8.00781	1223	11.99219	10.00002	0	9.99998 25
36	.02002	1190	.97998	.02004	1190	.97996	.00002	1	9.99998 24
37	.03192	1158	.96808	.03194	1159	.96806	.00003	0	9.99997 23
38	.04350	1128	.95650	.04353	1128	.95647	.00003	0	9.99997 22
39	.05478	1100	.94522	.05481	1100	.94519	.00003	0	9.99997 21
40	8.06578	1072	11.93422	8.06581	1072	11.93419	10.00003	0	9.99997 20
41	.07650	1046	.92350	.07653	1047	.92347	.00003	0	9.99997 19
42	.08696	1022	.91304	.08700	1022	.91300	.00003	0	9.99997 18
43	.09718	999	.90282	.09722	998	.90278	.00003	1	9.99997 17
44	.10717	976	.89283	.10720	976	.89280	.00004	0	9.99996 16
45	8.11693	954	11.88307	8.11696	955	11.88304	10.00004	0	9.99996 15
46	.12647	934	.87353	.12651	934	.87349	.00004	0	9.99996 14
47	.13581	914	.86419	.13585	915	.86415	.00004	0	9.99996 13
48	.14495	896	.85505	.14500	895	.85500	.00004	0	9.99996 12
49	.15391	877	.84609	.15395	878	.84605	.00004	1	9.99996 11
50	8.16268	860	11.83732	8.16273	860	11.83727	10.00005	0	9.99995 10
51	.17128	843	.82872	.17133	843	.82867	.00005	0	9.99995 9
52	.17971	827	.82029	.17976	828	.82024	.00005	0	9.99995 8
53	.18798	812	.81202	.18804	812	.81196	.00005	0	9.99995 7
54	.19610	797	.80390	.19616	797	.80384	.00005	1	9.99995 6
55	8.20407	782	11.79593	8.20413	782	11.79587	10.00006	0	9.99994 5
56	.21189	769	.78811	.21195	769	.78805	.00006	0	9.99994 4
57	.21958	755	.78042	.21964	756	.78036	.00006	0	9.99994 3
58	.22713	743	.77287	.22720	742	.77280	.00006	0	9.99994 2
59	.23456	730	.76544	.23462	730	.76538	.00006	1	9.99994 1
60	8.24186	730	11.75814	8.24192	730	11.75808	10.00007	1	9.99993 0
↑	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin +89°

Logarithms of Trigonometric Functions

1

1° ↓	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos ←178° ↓
0	8. 24186	717	11. 75814	8. 24192	718	11. 75808	10. 00007	0	9. 99993
1	. 24903	706	. 75097	. 24910	706	. 75090	. 00007	0	. 99993
2	. 25609	695	. 74391	. 25616	696	. 74384	. 00007	0	. 99993
3	. 26304	684	. 73696	. 26312	684	. 73688	. 00007	1	. 99993
4	. 26988	673	. 73012	. 26996	673	. 73004	. 00008	0	. 99992
5	8. 27661	663	11. 72339	8. 27669	663	11. 72331	10. 00008	0	9. 99992
6	. 28324	653	. 71676	. 28332	654	. 71668	. 00008	0	. 99992
7	. 28977	644	. 71023	. 28986	643	. 71014	. 00008	0	. 99992
8	. 29621	634	. 70379	. 29629	634	. 70371	. 00008	1	. 99992
9	. 30255	624	. 69745	. 30263	625	. 69737	. 00009	0	. 99991
10	8. 30879	616	11. 69121	8. 30888	617	11. 69112	10. 00009	0	9. 99991
11	. 31495	608	. 68505	. 31505	607	. 68495	. 00009	1	. 99991
12	. 32103	599	. 67897	. 32112	599	. 67888	. 00010	0	. 99990
13	. 32702	590	. 67298	. 32711	591	. 67289	. 00010	0	. 99990
14	. 33292	583	. 66703	. 33302	584	. 66698	. 00010	0	. 99990
15	8. 33875	575	11. 66125	8. 33886	575	11. 66114	10. 00010	1	9. 99990
16	. 34450	568	. 65550	. 34461	568	. 65539	. 00011	0	. 99989
17	. 35018	560	. 64982	. 35029	561	. 64971	. 00011	0	. 99989
18	. 35578	553	. 64422	. 35590	553	. 64410	. 00011	0	. 99989
19	. 36131	547	. 63869	. 36143	546	. 63857	. 00011	1	. 99989
20	8. 36678	539	11. 63322	8. 36689	540	11. 63311	10. 00012	0	9. 99988
21	. 37217	533	. 62783	. 37229	533	. 62771	. 00012	0	. 99988
22	. 37750	526	. 62250	. 37762	527	. 62238	. 00012	1	. 99988
23	. 38276	520	. 61724	. 38289	520	. 61711	. 00013	0	. 99987
24	. 38796	514	. 61204	. 38809	514	. 61191	. 00013	0	. 99987
25	8. 39310	508	11. 60690	8. 39323	509	11. 60677	10. 00013	1	9. 99987
26	. 39818	502	. 60182	. 39832	502	. 60168	. 00014	0	. 99986
27	. 40320	496	. 59680	. 40334	496	. 59666	. 00014	0	. 99986
28	. 40816	491	. 59184	. 40830	491	. 59170	. 00014	1	. 99986
29	. 41307	485	. 58693	. 41321	486	. 58679	. 00015	0	. 99985
30	8. 41792	480	11. 58208	8. 41807	480	11. 58193	10. 00015	0	9. 99985
31	. 42272	474	. 57728	. 42287	475	. 57713	. 00015	1	. 99985
32	. 42746	470	. 57254	. 42762	470	. 57238	. 00016	0	. 99984
33	. 43216	464	. 56784	. 43232	464	. 56768	. 00016	0	. 99984
34	. 43680	459	. 56320	. 43696	460	. 56304	. 00016	1	. 99984
35	8. 44139	455	11. 55861	8. 44156	455	11. 55844	10. 00017	0	9. 99983
36	. 44594	450	. 55406	. 44611	450	. 55389	. 00017	0	. 99983
37	. 45044	445	. 54956	. 45061	446	. 54939	. 00017	1	. 99983
38	. 45489	441	. 54511	. 45507	441	. 54493	. 00018	0	. 99982
39	. 45930	436	. 54070	. 45948	437	. 54052	. 00018	0	. 99982
40	8. 46366	433	11. 53634	8. 46385	432	11. 53615	10. 00018	1	9. 99982
41	. 46799	427	. 53201	. 46817	428	. 53183	. 00019	0	. 99981
42	. 47226	424	. 52774	. 47245	424	. 52755	. 00019	0	. 99981
43	. 47650	419	. 52350	. 47669	420	. 52331	. 00019	1	. 99981
44	. 48069	416	. 51931	. 48089	416	. 51911	. 00020	0	. 99980
45	8. 48485	411	11. 51515	8. 48505	412	11. 51495	10. 00020	1	9. 99980
46	. 48896	408	. 51104	. 48917	408	. 51083	. 00021	0	. 99979
47	. 49304	404	. 50696	. 49325	404	. 50675	. 00021	0	. 99979
48	. 49708	400	. 50292	. 49729	401	. 50271	. 00021	1	. 99979
49	. 50108	396	. 49892	. 50130	397	. 49870	. 00022	0	. 99978
50	8. 50504	393	11. 49496	8. 50527	393	11. 49473	10. 00022	1	9. 99978
51	. 50897	390	. 49103	. 50920	390	. 49080	. 00023	0	. 99977
52	. 51287	386	. 48713	. 51310	386	. 48690	. 00023	0	. 99977
53	. 51673	382	. 48327	. 51696	383	. 48304	. 00023	1	. 99977
54	. 52055	379	. 47945	. 52079	380	. 47921	. 00024	0	. 99976
55	8. 52434	376	11. 47566	8. 52459	376	11. 47541	10. 00024	1	9. 99976
56	. 52810	373	. 47190	. 52835	373	. 47165	. 00025	0	. 99975
57	. 53183	369	. 46817	. 53208	370	. 46792	. 00025	1	. 99975
58	. 53552	367	. 46448	. 53578	367	. 46422	. 00026	0	. 99974
59	. 53919	363	. 46081	. 53945	363	. 46055	. 00026	0	. 99974
60	8. 54282	363	11. 45718	8. 54308	363	11. 45692	10. 00026	0	9. 99974
↑ 91°	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin ←88° ↑

1

Logarithms of Trigonometric Functions

2° ↓	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos +177° ↓
0	8.54282	360	11.45718	8.54308	361	11.45692	10.00026	1	9.99974
1	.54642	357	.45358	.54669	358	.45331	.00027	0	.99973
2	.54999	355	.45001	.55027	355	.44973	.00027	1	.99973
3	.55354	351	.44646	.55382	352	.44618	.00028	0	.99972
4	.55705	349	.44295	.55734	349	.44266	.00028	1	.99972
5	8.56054	346	11.43946	8.56083	346	11.43917	10.00029	0	9.99971
6	.56400	343	.43600	.56429	344	.43571	.00029	1	.99971
7	.56743	341	.43257	.56773	341	.43227	.00030	0	.99970
8	.57084	337	.42916	.57114	338	.42886	.00030	1	.99970
9	.57421	336	.42579	.57452	336	.42548	.00031	0	.99969
10	8.57757	332	11.42243	8.57788	333	11.42212	10.00031	1	9.99969
11	.58089	330	.41911	.58121	330	.41879	.00032	0	.99968
12	.58419	328	.41581	.58451	328	.41549	.00032	1	.99968
13	.58747	325	.41253	.58779	326	.41221	.00033	0	.99967
14	.59072	323	.40928	.59105	323	.40895	.00033	1	.99967
15	8.59395	320	11.40605	8.59428	321	11.40572	10.00033	0	9.99967
16	.59715	318	.40285	.59749	319	.40251	.00034	1	.99966
17	.60033	316	.39967	.60068	316	.39932	.00034	0	.99966
18	.60349	313	.39651	.60384	314	.39616	.00035	1	.99965
19	.60662	311	.39338	.60698	311	.39302	.00036	0	.99964
20	8.60973	309	11.39027	8.61009	310	11.38991	10.00036	1	9.99964
21	.61282	307	.38718	.61319	307	.38681	.00037	0	.99963
22	.61589	305	.38411	.61626	305	.38374	.00037	1	.99963
23	.61894	302	.38106	.61931	303	.38069	.00038	0	.99962
24	.62196	301	.37804	.62234	301	.37766	.00038	1	.99962
25	8.62497	298	11.37503	8.62535	299	11.37465	10.00039	0	9.99961
26	.62795	296	.37205	.62834	297	.37166	.00039	1	.99961
27	.63091	294	.36909	.63131	295	.36869	.00040	0	.99960
28	.63385	293	.36615	.63426	292	.36574	.00040	1	.99960
29	.63678	290	.36322	.63718	291	.36282	.00041	0	.99959
30	8.63968	288	11.36032	8.64009	289	11.35991	10.00041	1	9.99959
31	.64256	287	.35744	.64298	287	.35702	.00042	0	.99958
32	.64543	284	.35457	.64585	285	.35415	.00042	1	.99958
33	.64827	283	.35173	.64870	284	.35130	.00043	0	.99957
34	.65110	281	.34890	.65154	281	.34846	.00044	1	.99956
35	8.65391	279	11.34609	8.65435	280	11.34565	10.00044	0	9.99956
36	.65670	277	.34330	.65715	278	.34285	.00045	1	.99955
37	.65947	276	.34053	.65993	276	.34007	.00045	0	.99955
38	.66223	274	.33777	.66269	274	.33731	.00046	1	.99954
39	.66497	272	.33503	.66543	273	.33457	.00046	0	.99954
40	8.66769	270	11.33231	8.66816	271	11.33184	10.00047	1	9.99953
41	.67039	269	.32961	.67087	269	.32913	.00048	0	.99952
42	.67308	267	.32692	.67356	268	.32644	.00048	1	.99952
43	.67575	266	.32425	.67624	266	.32376	.00049	0	.99951
44	.67841	263	.32159	.67890	264	.32110	.00049	1	.99951
45	8.68104	263	11.31896	8.68154	263	11.31846	10.00050	0	9.99950
46	.68367	260	.31633	.68417	261	.31583	.00051	1	.99949
47	.68627	259	.31373	.68678	260	.31322	.00051	0	.99949
48	.68886	258	.31114	.68938	258	.31062	.00052	1	.99948
49	.69144	256	.30856	.69196	257	.30804	.00052	0	.99948
50	8.69400	254	11.30600	8.69453	255	11.30547	10.00053	1	9.99947
51	.69654	253	.30346	.69708	254	.30292	.00054	0	.99946
52	.69907	252	.30093	.69962	252	.30038	.00054	1	.99946
53	.70159	250	.29841	.70214	251	.29786	.00055	0	.99945
54	.70409	249	.29591	.70465	249	.29535	.00056	1	.99944
55	8.70658	247	11.29342	8.70714	248	11.29286	10.00056	0	9.99944
56	.70905	246	.29095	.70962	246	.29038	.00057	1	.99943
57	.71151	244	.28849	.71208	245	.28792	.00058	0	.99942
58	.71395	243	.28605	.71453	244	.28547	.00058	1	.99942
59	.71638	242	.28362	.71697	243	.28303	.00059	0	.99941
60	8.71880		11.28120	8.71940		11.28060	10.00060	1	9.99940
92° ↑	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin +87° ↑

Logarithms of Trigonometric Functions

1

3° ↓	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos ←176° ↓
0	8. 71880	240	11. 28120	8. 71940	241	11. 28060	10. 00060	0	9. 99940 60
1	. 72120	239	. 27880	. 72181	239	. 27819	. 00060	1	. 99940 59
2	. 72359	238	. 27641	. 72420	239	. 27580	. 00061	1	. 99939 58
3	. 72597	237	. 27403	. 72659	237	. 27341	. 00062	0	. 99938 57
4	. 72834	235	. 27166	. 72896	236	. 27104	. 00062	1	. 99938 56
5	8. 73069	234	11. 26931	8. 73132	234	11. 26868	10. 00063	1	9. 99937 55
6	. 73303	232	. 26697	. 73366	234	. 26634	. 00064	0	. 99936 54
7	. 73535	232	. 26465	. 73600	232	. 26400	. 00064	1	. 99936 53
8	. 73767	230	. 26233	. 73832	231	. 26168	. 00065	1	. 99935 52
9	. 73997	229	. 26003	. 74063	229	. 25937	. 00066	0	. 99934 51
10	8. 74226	228	11. 25774	8. 74292	229	11. 25708	10. 00066	1	9. 99934 50
11	. 74454	226	. 25546	. 74521	227	. 25479	. 00067	1	. 99933 49
12	. 74680	226	. 25320	. 74748	226	. 25252	. 00068	0	. 99932 48
13	. 74906	224	. 25094	. 74974	225	. 25026	. 00068	1	. 99932 47
14	. 75130	223	. 24870	. 75199	224	. 24801	. 00069	1	. 99931 46
15	8. 75353	222	11. 24647	8. 75423	222	11. 24577	10. 00070	1	9. 99930 45
16	. 75575	220	. 24425	. 75645	222	. 24355	. 00071	0	. 99929 44
17	. 75795	220	. 24205	. 75867	220	. 24133	. 00071	1	. 99929 43
18	. 76015	219	. 23985	. 76087	219	. 23913	. 00072	1	. 99928 42
19	. 76234	217	. 23766	. 76306	219	. 23694	. 00073	1	. 99927 41
20	8. 76451	216	11. 23549	8. 76525	217	11. 23475	10. 00074	0	9. 99926 40
21	. 76667	216	. 23333	. 76742	216	. 23258	. 00074	1	. 99926 39
22	. 76883	214	. 23117	. 76958	215	. 23042	. 00075	1	. 99925 38
23	. 77097	213	. 22903	. 77173	214	. 22827	. 00076	1	. 99924 37
24	. 77310	212	. 22690	. 77387	213	. 22613	. 00077	0	. 99923 36
25	8. 77522	211	11. 22478	8. 77600	211	11. 22400	10. 00077	1	9. 99923 35
26	. 77733	210	. 22267	. 77811	211	. 22189	. 00078	1	. 99922 34
27	. 77943	209	. 22057	. 78022	210	. 21978	. 00079	1	. 99921 33
28	. 78152	208	. 21848	. 78232	209	. 21768	. 00080	0	. 99920 32
29	. 78360	208	. 21640	. 78441	208	. 21559	. 00080	1	. 99920 31
30	8. 78568	206	11. 21432	8. 78649	206	11. 21351	10. 00081	1	9. 99919 30
31	. 78774	205	. 21226	. 78855	206	. 21145	. 00082	1	. 99918 29
32	. 78979	204	. 21021	. 79061	205	. 20939	. 00083	0	. 99917 28
33	. 79183	203	. 20817	. 79266	204	. 20734	. 00083	1	. 99917 27
34	. 79386	202	. 20614	. 79470	203	. 20530	. 00084	1	. 99916 26
35	8. 79588	201	11. 20412	8. 79673	202	11. 20327	10. 00085	1	9. 99915 25
36	. 79789	201	. 20211	. 79875	201	. 20125	. 00086	1	. 99914 24
37	. 79990	199	. 20010	. 80076	201	. 19924	. 00087	0	. 99913 23
38	. 80189	199	. 19811	. 80277	199	. 19723	. 00087	1	. 99913 22
39	. 80388	197	. 19612	. 80476	198	. 19524	. 00088	1	. 99912 21
40	8. 80585	197	11. 19415	8. 80674	198	11. 19326	10. 00089	1	9. 99911 20
41	. 80782	196	. 19218	. 80872	196	. 19128	. 00090	1	. 99910 19
42	. 80978	195	. 19022	. 81068	196	. 18932	. 00091	0	. 99909 18
43	. 81173	194	. 18827	. 81264	195	. 18736	. 00091	1	. 99909 17
44	. 81367	193	. 18633	. 81459	194	. 18541	. 00092	1	. 99908 16
45	8. 81560	192	11. 18440	8. 81653	193	11. 18347	10. 00093	1	9. 99907 15
46	. 81752	192	. 18248	. 81846	192	. 18154	. 00094	1	. 99906 14
47	. 81944	190	. 18056	. 82038	192	. 17962	. 00095	1	. 99905 13
48	. 82134	190	. 17866	. 82230	190	. 17770	. 00096	0	. 99904 12
49	. 82324	189	. 17676	. 82420	190	. 17580	. 00096	1	. 99904 11
50	8. 82513	188	11. 17487	8. 82610	189	11. 17390	10. 00097	1	9. 99903 10
51	. 82701	187	. 17299	. 82799	188	. 17201	. 00098	1	. 99902 9
52	. 82888	187	. 17112	. 82987	188	. 17013	. 00099	1	. 99901 8
53	. 83075	186	. 16925	. 83175	186	. 16825	. 00100	1	. 99900 7
54	. 83261	185	. 16739	. 83361	186	. 16639	. 00101	1	. 99899 6
55	8. 83446	184	11. 16554	8. 83547	185	11. 16453	10. 00102	0	9. 99898 5
56	. 83630	183	. 16370	. 83732	184	. 16268	. 00102	1	. 99898 4
57	. 83813	183	. 16187	. 83916	184	. 16084	. 00103	1	. 99897 3
58	. 83996	181	. 16004	. 84100	182	. 15900	. 00104	1	. 99896 2
59	. 84177	181	. 15823	. 84282	182	. 15718	. 00105	1	. 99895 1
60	8. 84358	181	11. 15642	8. 84464	182	11. 15536	10. 00106	1	9. 99894 0
↑ 93°	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin ↑ 86°

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Logarithms of Trigonometric Functions

4°→	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos ←175° ↓	
0	8.84358	181	11.15642	8.84464	182	11.15536	10.00106	1	9.99894	60
1	.84539	179	.15461	.84646	180	.15354	.00107	1	.99893	59
2	.84718	179	.15282	.84826	180	.15174	.00108	1	.99892	58
3	.84897	178	.15103	.85006	179	.14994	.00109	0	.99891	57
4	.85075	177	.14925	.85185	178	.14815	.00109	1	.99891	56
5	8.85252	177	11.14748	8.85363	177	11.14637	10.00110	1	9.99890	55
6	.85429	176	.14571	.85540	177	.14460	.00111	1	.99889	54
7	.85605	175	.14395	.85717	176	.14283	.00112	1	.99888	53
8	.85780	175	.14220	.85893	176	.14107	.00113	1	.99887	52
9	.85955	173	.14045	.86069	174	.13931	.00114	1	.99886	51
10	8.86128	173	11.13872	8.86243	174	11.13757	10.00115	1	9.99885	50
11	.86301	173	.13699	.86417	174	.13583	.00116	1	.99884	49
12	.86474	171	.13526	.86591	172	.13409	.00117	1	.99883	48
13	.86645	171	.13355	.86763	172	.13237	.00118	1	.99882	47
14	.86816	171	.13184	.86935	171	.13065	.00119	1	.99881	46
15	8.86987	169	11.13013	8.87106	171	11.12894	10.00120	1	9.99880	45
16	.87156	169	.12844	.87277	170	.12723	.00121	0	.99879	44
17	.87325	169	.12675	.87447	169	.12553	.00121	1	.99879	43
18	.87494	167	.12506	.87616	169	.12384	.00122	1	.99878	42
19	.87661	168	.12339	.87785	168	.12215	.00123	1	.99877	41
20	8.87829	166	11.12171	8.87953	167	11.12047	10.00124	1	9.99876	40
21	.87995	166	.12005	.88120	167	.11880	.00125	1	.99875	39
22	.88161	165	.11839	.88287	166	.11713	.00126	1	.99874	38
23	.88326	164	.11674	.88453	165	.11547	.00127	1	.99873	37
24	.88490	164	.11510	.88618	165	.11382	.00128	1	.99872	36
25	8.88654	163	11.11346	8.88783	165	11.11217	10.00129	1	9.99871	35
26	.88817	163	.11183	.88948	163	.11052	.00130	1	.99870	34
27	.88980	162	.11020	.89111	163	.10889	.00131	1	.99869	33
28	.89142	162	.10858	.89274	163	.10726	.00132	1	.99868	32
29	.89304	160	.10696	.89437	161	.10563	.00133	1	.99867	31
30	8.89464	161	11.10536	8.89598	162	11.10402	10.00134	1	9.99866	30
31	.89625	159	.10375	.89760	160	.10240	.00135	1	.99865	29
32	.89784	159	.10216	.89920	160	.10080	.00136	1	.99864	28
33	.89943	159	.10057	.90080	160	.09920	.00137	1	.99863	27
34	.90102	158	.09898	.90240	159	.09760	.00138	1	.99862	26
35	8.90260	157	11.09740	8.90399	158	11.09601	10.00139	1	9.99861	25
36	.90417	157	.09583	.90557	158	.09443	.00140	1	.99860	24
37	.90574	156	.09426	.90715	157	.09285	.00141	1	.99859	23
38	.90730	155	.09270	.90872	157	.09128	.00142	1	.99858	22
39	.90885	155	.09115	.91029	156	.08971	.00143	1	.99857	21
40	8.91040	155	11.08960	8.91185	155	11.08815	10.00144	1	9.99856	20
41	.91195	154	.08805	.91340	155	.08660	.00145	1	.99855	19
42	.91349	153	.08651	.91495	155	.08505	.00146	1	.99854	18
43	.91502	153	.08498	.91650	153	.08350	.00147	1	.99853	17
44	.91655	152	.08345	.91803	154	.08197	.00148	1	.99852	16
45	8.91807	152	11.08193	8.91957	153	11.08043	10.00149	1	9.99851	15
46	.91959	151	.08041	.92110	152	.07890	.00150	2	.99850	14
47	.92110	151	.07890	.92262	152	.07738	.00152	1	.99848	13
48	.92261	150	.07739	.92414	151	.07586	.00153	1	.99847	12
49	.92411	150	.07589	.92565	151	.07435	.00154	1	.99846	11
50	8.92561	149	11.07439	8.92716	150	11.07284	10.00155	1	9.99845	10
51	.92710	149	.07290	.92866	150	.07134	.00156	1	.99844	9
52	.92859	148	.07141	.93016	149	.06984	.00157	1	.99843	8
53	.93007	147	.06993	.93165	148	.06835	.00158	1	.99842	7
54	.93154	147	.06846	.93313	149	.06687	.00159	1	.99841	6
55	8.93301	147	11.06699	8.93462	147	11.06538	10.00160	1	9.99840	5
56	.93448	146	.06552	.93609	147	.06391	.00161	1	.99839	4
57	.93594	146	.06406	.93756	147	.06244	.00162	1	.99838	3
58	.93740	145	.06260	.93903	146	.06097	.00163	1	.99837	2
59	.93885	145	.06115	.94049	146	.05951	.00164	2	.99836	1
60	8.94030	145	11.05970	8.94195	146	11.05805	10.00166		9.99834	0
↑ 94°→	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin ↑ +85°	

Logarithms of Trigonometric Functions

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5° ↓	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos ←174° ↓	
0	8.94030	144	11.05970	8.94195	145	11.05805	10.00166	1	9.99834	60
1	.94174	143	.05826	.94340	145	.05660	.00167	1	.99833	59
2	.94317	144	.05683	.94485	145	.05515	.00168	1	.99832	58
3	.94461	142	.05539	.94630	143	.05370	.00169	1	.99831	57
4	.94603	143	.05397	.94773	144	.05227	.00170	1	.99830	56
5	8.94746	141	11.05254	8.94917	143	11.05083	10.00171	1	9.99829	55
6	.94887	142	.05113	.95060	142	.04940	.00172	1	.99828	54
7	.95029	141	.04971	.95202	142	.04798	.00173	2	.99827	53
8	.95170	140	.04830	.95344	142	.04656	.00175	1	.99825	52
9	.95310	140	.04690	.95486	141	.04514	.00176	1	.99824	51
10	8.95450	139	11.04550	8.95627	140	11.04373	10.00177	1	9.99823	50
11	.95589	139	.04411	.95767	141	.04233	.00178	1	.99822	49
12	.95728	139	.04272	.95908	139	.04092	.00179	1	.99821	48
13	.95867	138	.04133	.96047	140	.03953	.00180	1	.99820	47
14	.96005	138	.03995	.96187	138	.03813	.00181	2	.99819	46
15	8.96143	137	11.03857	8.96325	139	11.03675	10.00183	1	9.99817	45
16	.96280	137	.03720	.96464	138	.03536	.00184	1	.99816	44
17	.96417	136	.03583	.96602	137	.03398	.00185	1	.99815	43
18	.96553	136	.03447	.96739	138	.03261	.00186	1	.99814	42
19	.96689	136	.03311	.96877	136	.03123	.00187	1	.99813	41
20	8.96825	135	11.03175	8.97013	137	11.02987	10.00188	2	9.99812	40
21	.96960	135	.03040	.97150	135	.02850	.00190	1	.99810	39
22	.97095	134	.02905	.97285	136	.02715	.00191	1	.99809	38
23	.97229	134	.02771	.97421	135	.02579	.00192	1	.99808	37
24	.97363	133	.02637	.97556	135	.02444	.00193	1	.99807	36
25	8.97496	133	11.02504	8.97691	134	11.02309	10.00194	2	9.99806	35
26	.97629	133	.02371	.97825	134	.02175	.00196	1	.99804	34
27	.97762	132	.02238	.97959	133	.02041	.00197	1	.99803	33
28	.97894	132	.02106	.98092	133	.01908	.00198	1	.99802	32
29	.98026	131	.01974	.98225	133	.01775	.00199	1	.99801	31
30	8.98157	131	11.01843	8.98358	132	11.01642	10.00200	2	9.99800	30
31	.98288	131	.01712	.98490	132	.01510	.00202	1	.99798	29
32	.98419	130	.01581	.98622	131	.01378	.00203	1	.99797	28
33	.98549	130	.01451	.98753	131	.01247	.00204	1	.99796	27
34	.98679	129	.01321	.98884	131	.01116	.00205	2	.99795	26
35	8.98808	129	11.01192	8.99015	130	11.00985	10.00207	1	9.99793	25
36	.98937	129	.01063	.99145	130	.00855	.00208	1	.99792	24
37	.99066	128	.00934	.99275	130	.00725	.00209	1	.99791	23
38	.99194	128	.00806	.99405	129	.00595	.00210	2	.99790	22
39	.99322	128	.00678	.99534	128	.00466	.00212	1	.99788	21
40	8.99450	127	11.00550	8.99662	129	11.00338	10.00213	1	9.99787	20
41	.99577	127	.00423	.99791	128	.00209	.00214	1	.99786	19
42	.99704	126	.00296	8.99919	127	11.00081	.00215	2	.99785	18
43	.99830	126	.00170	9.00046	128	10.99954	.00217	1	.99783	17
44	8.99956	126	11.00044	9.00174	127	.99826	.00218	1	.99782	16
45	9.00082	125	10.99918	9.00301	126	10.99699	10.00219	1	9.99781	15
46	.00207	125	.99793	.00427	126	.99573	.00220	2	.99780	14
47	.00332	124	.99668	.00553	126	.99447	.00222	1	.99778	13
48	.00456	125	.99544	.00679	126	.99321	.00223	1	.99777	12
49	.00581	123	.99419	.00805	125	.99195	.00224	1	.99776	11
50	9.00704	124	10.99296	9.00930	125	10.99070	10.00225	2	9.99775	10
51	.00828	123	.99172	.01055	124	.98945	.00227	1	.99773	9
52	.00951	122	.99049	.01179	124	.98821	.00228	1	.99772	8
53	.01074	122	.98926	.01303	124	.98697	.00229	2	.99771	7
54	.01196	122	.98804	.01427	123	.98573	.00231	1	.99769	6
55	9.01318	122	10.98682	9.01550	123	10.98450	10.00232	1	9.99768	5
56	.01440	121	.98560	.01673	123	.98327	.00233	2	.99767	4
57	.01561	121	.98439	.01796	122	.98204	.00235	1	.99765	3
58	.01682	121	.98318	.01918	122	.98082	.00236	1	.99764	2
59	.01803	121	.98197	.02040	122	.97960	.00237	2	.99763	1
60	9.01923	120	10.98077	9.02162	122	10.97838	10.00239		9.99761	0
↑ 95°	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin ←84° ↑	

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Logarithms of Trigonometric Functions

6° →	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos	← 173°
0	9. 01923	120	10. 98077	9. 02162	121	10. 97838	10. 00239	1	9. 99761	60
1	9. 02043	120	9. 97957	9. 02283	121	9. 97717	10. 00240	1	9. 99760	59
2	9. 02163	120	9. 97837	9. 02404	121	9. 97596	10. 00241	2	9. 99759	58
3	9. 02283	119	9. 97717	9. 02525	120	9. 97475	10. 00243	1	9. 99757	57
4	9. 02402	118	9. 97598	9. 02645	121	9. 97355	10. 00244	1	9. 99756	56
5	9. 02520	118	10. 97480	9. 02766	119	10. 97234	10. 00245	2	9. 99755	55
6	9. 02639	118	9. 97361	9. 02885	120	9. 97115	10. 00247	1	9. 99753	54
7	9. 02757	117	9. 97243	9. 03005	119	9. 96995	10. 00248	1	9. 99752	53
8	9. 02874	118	9. 97126	9. 03124	118	9. 96876	10. 00249	2	9. 99751	52
9	9. 02992	117	9. 97008	9. 03242	119	9. 96758	10. 00251	1	9. 99749	51
10	9. 03109	117	10. 96891	9. 03361	118	10. 96639	10. 00252	1	9. 99748	50
11	9. 03226	116	9. 96774	9. 03479	118	9. 96521	10. 00253	2	9. 99747	49
12	9. 03342	116	9. 96658	9. 03597	117	9. 96403	10. 00255	1	9. 99745	48
13	9. 03458	116	9. 96542	9. 03714	118	9. 96286	10. 00256	2	9. 99744	47
14	9. 03574	116	9. 96426	9. 03832	116	9. 96168	10. 00258	1	9. 99742	46
15	9. 03690	115	10. 96310	9. 03948	117	10. 96052	10. 00259	1	9. 99741	45
16	9. 03805	115	9. 96195	9. 04065	116	9. 95935	10. 00260	2	9. 99740	44
17	9. 03920	114	9. 96080	9. 04181	116	9. 95819	10. 00262	1	9. 99738	43
18	9. 04034	115	9. 95966	9. 04297	116	9. 95703	10. 00263	1	9. 99737	42
19	9. 04149	113	9. 95851	9. 04413	115	9. 95587	10. 00264	2	9. 99736	41
20	9. 04262	114	10. 95738	9. 04528	115	10. 95472	10. 00266	1	9. 99734	40
21	9. 04376	114	9. 95624	9. 04643	115	9. 95357	10. 00267	1	9. 99733	39
22	9. 04490	113	9. 95510	9. 04758	115	9. 95242	10. 00269	2	9. 99731	38
23	9. 04603	112	9. 95397	9. 04873	114	9. 95127	10. 00270	1	9. 99730	37
24	9. 04715	113	9. 95285	9. 04987	114	9. 95013	10. 00272	1	9. 99728	36
25	9. 04828	112	10. 95172	9. 05101	113	10. 94899	10. 00273	1	9. 99727	35
26	9. 04940	112	9. 95060	9. 05214	114	9. 94786	10. 00274	2	9. 99726	34
27	9. 05052	112	9. 94948	9. 05328	113	9. 94672	10. 00276	1	9. 99724	33
28	9. 05164	112	9. 94836	9. 05441	112	9. 94559	10. 00277	2	9. 99723	32
29	9. 05275	111	9. 94725	9. 05553	113	9. 94447	10. 00279	1	9. 99721	31
30	9. 05386	111	10. 94614	9. 05666	112	10. 94334	10. 00280	2	9. 99720	30
31	9. 05497	110	9. 94503	9. 05778	112	9. 94222	10. 00282	1	9. 99718	29
32	9. 05607	110	9. 94393	9. 05890	112	9. 94110	10. 00283	1	9. 99717	28
33	9. 05717	110	9. 94283	9. 06002	111	9. 93998	10. 00284	2	9. 99716	27
34	9. 05827	110	9. 94173	9. 06113	111	9. 93887	10. 00286	1	9. 99714	26
35	9. 05937	109	10. 94063	9. 06224	111	10. 93776	10. 00287	2	9. 99713	25
36	9. 06046	109	9. 93954	9. 06335	110	9. 93665	10. 00289	1	9. 99711	24
37	9. 06155	109	9. 93845	9. 06445	110	9. 93555	10. 00290	2	9. 99710	23
38	9. 06264	108	9. 93736	9. 06556	111	9. 93444	10. 00292	1	9. 99708	22
39	9. 06372	109	9. 93628	9. 06666	109	9. 93334	10. 00293	2	9. 99707	21
40	9. 06481	108	10. 93519	9. 06775	110	10. 93225	10. 00295	1	9. 99705	20
41	9. 06589	107	9. 93411	9. 06885	109	9. 93115	10. 00296	2	9. 99704	19
42	9. 06696	108	9. 93304	9. 06994	109	9. 93006	10. 00298	1	9. 99702	18
43	9. 06804	107	9. 93196	9. 07103	108	9. 92897	10. 00299	2	9. 99701	17
44	9. 06911	107	9. 93089	9. 07211	109	9. 92789	10. 00301	1	9. 99699	16
45	9. 07018	106	10. 92982	9. 07320	108	10. 92680	10. 00302	2	9. 99698	15
46	9. 07124	107	9. 92876	9. 07428	108	9. 92572	10. 00304	1	9. 99696	14
47	9. 07231	106	9. 92769	9. 07536	107	9. 92464	10. 00305	2	9. 99695	13
48	9. 07337	105	9. 92663	9. 07643	108	9. 92357	10. 00307	1	9. 99693	12
49	9. 07442	106	9. 92558	9. 07751	107	9. 92249	10. 00308	2	9. 99692	11
50	9. 07548	105	10. 92452	9. 07858	106	10. 92142	10. 00310	1	9. 99690	10
51	9. 07653	105	9. 92347	9. 07964	107	9. 92036	10. 00311	2	9. 99689	9
52	9. 07758	105	9. 92242	9. 08071	106	9. 91929	10. 00313	1	9. 99687	8
53	9. 07863	105	9. 92137	9. 08177	106	9. 91823	10. 00314	2	9. 99686	7
54	9. 07968	104	9. 92032	9. 08283	106	9. 91717	10. 00316	1	9. 99684	6
55	9. 08072	104	10. 91928	9. 08389	106	10. 91611	10. 00317	2	9. 99683	5
56	9. 08176	104	9. 91824	9. 08495	105	9. 91505	10. 00319	1	9. 99681	4
57	9. 08280	103	9. 91720	9. 08600	105	9. 91400	10. 00320	2	9. 99680	3
58	9. 08383	103	9. 91617	9. 08705	105	9. 91295	10. 00322	1	9. 99678	2
59	9. 08489	103	9. 91514	9. 08810	104	9. 91190	10. 00323	2	9. 99677	1
60	9. 08589	103	10. 91411	9. 08914	104	10. 91086	10. 00325	1	9. 99675	0
↑ 96° →	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin	← 83°

Logarithms of Trigonometric Functions.

1

7°→ ↓	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos ←172° ↓
0	9. 08589	103	10. 91414	9. 08914	105	10. 91086	10. 00325	1	9. 99675
1	. 08692	103	. 91308	. 09019	104	. 90981	. 00326	2	. 99674
2	. 08795	102	. 91205	. 09123	104	. 90877	. 00328	2	. 99672
3	. 08897	102	. 91103	. 09227	103	. 90773	. 00330	1	. 99670
4	. 08999	102	. 91001	. 09330	103	. 90670	. 00331	2	. 99669
5	9. 09101	101	10. 90899	9. 09434	103	10. 90566	10. 00333	1	9. 99667
6	. 09202	102	. 90798	. 09537	103	. 90463	. 00334	2	. 99666
7	. 09304	101	. 90696	. 09640	102	. 90360	. 00336	1	. 99664
8	. 09405	101	. 90595	. 09742	103	. 90258	. 00337	2	. 99663
9	. 09506	100	. 90494	. 09845	102	. 90155	. 00339	2	. 99661
10	9. 09606	101	10. 90394	9. 09947	102	10. 90053	10. 00341	1	9. 99659
11	. 09707	100	. 90293	. 10049	101	. 89951	. 00342	2	. 99658
12	. 09807	100	. 90193	. 10150	102	. 89850	. 00344	1	. 99656
13	. 09907	99	. 90093	. 10252	101	. 89748	. 00345	2	. 99655
14	. 10006	100	. 89994	. 10353	101	. 89647	. 00347	2	. 99653
15	9. 10106	99	10. 89894	9. 10454	101	10. 89546	10. 00349	1	9. 99651
16	. 10205	99	. 89795	. 10555	101	. 89445	. 00350	2	. 99650
17	. 10304	98	. 89696	. 10656	100	. 89344	. 00352	1	. 99648
18	. 10402	99	. 89598	. 10756	100	. 89244	. 00353	2	. 99647
19	. 10501	98	. 89499	. 10856	100	. 89144	. 00355	2	. 99645
20	9. 10599	98	10. 89401	9. 10956	100	10. 89044	10. 00357	1	9. 99643
21	. 10697	98	. 89303	. 11056	99	. 88944	. 00358	2	. 99642
22	. 10795	98	. 89205	. 11155	99	. 88845	. 00360	2	. 99640
23	. 10893	97	. 89107	. 11254	99	. 88746	. 00362	1	. 99638
24	. 10990	97	. 89010	. 11353	99	. 88647	. 00363	2	. 99637
25	9. 11087	97	10. 88913	9. 11452	99	10. 88548	10. 00365	2	9. 99635
26	. 11184	97	. 88816	. 11551	98	. 88449	. 00367	1	. 99633
27	. 11281	96	. 88719	. 11649	98	. 88351	. 00368	2	. 99632
28	. 11377	97	. 88623	. 11747	98	. 88253	. 00370	1	. 99630
29	. 11474	96	. 88526	. 11845	98	. 88155	. 00371	2	. 99629
30	9. 11570	96	10. 88430	9. 11943	97	10. 88057	10. 00373	2	9. 99627
31	. 11666	95	. 88334	. 12040	98	. 87960	. 00375	1	. 99625
32	. 11761	96	. 88239	. 12138	97	. 87862	. 00376	2	. 99624
33	. 11857	95	. 88143	. 12235	97	. 87765	. 00378	2	. 99622
34	. 11952	95	. 88048	. 12332	96	. 87668	. 00380	2	. 99620
35	9. 12047	95	10. 87953	9. 12428	97	10. 87572	10. 00382	1	9. 99618
36	. 12142	94	. 87858	. 12525	96	. 87475	. 00383	2	. 99617
37	. 12236	95	. 87764	. 12621	96	. 87379	. 00385	2	. 99615
38	. 12331	94	. 87669	. 12717	96	. 87283	. 00387	1	. 99613
39	. 12425	94	. 87575	. 12813	96	. 87187	. 00388	2	. 99612
40	9. 12519	93	10. 87481	9. 12909	95	10. 87091	10. 00390	2	9. 99610
41	. 12612	94	. 87388	. 13004	95	. 86996	. 00392	1	. 99608
42	. 12706	93	. 87294	. 13099	95	. 86901	. 00393	2	. 99607
43	. 12799	93	. 87201	. 13194	95	. 86806	. 00395	2	. 99605
44	. 12892	93	. 87108	. 13289	95	. 86711	. 00397	2	. 99603
45	9. 12985	93	10. 87015	9. 13384	94	10. 86616	10. 00399	1	9. 99601
46	. 13078	93	. 86922	. 13478	95	. 86522	. 00400	2	. 99600
47	. 13171	92	. 86829	. 13573	94	. 86427	. 00402	2	. 99598
48	. 13263	92	. 86737	. 13667	94	. 86333	. 00404	1	. 99596
49	. 13355	92	. 86645	. 13761	93	. 86239	. 00405	2	. 99595
50	9. 13447	92	10. 86553	9. 13854	94	10. 86146	10. 00407	2	9. 99593
51	. 13539	91	. 86461	. 13948	93	. 86052	. 00409	2	. 99591
52	. 13630	92	. 86370	. 14041	93	. 85959	. 00411	1	. 99589
53	. 13722	91	. 86278	. 14134	93	. 85866	. 00412	2	. 99588
54	. 13813	91	. 86187	. 14227	93	. 85773	. 00414	2	. 99586
55	9. 13904	90	10. 86096	9. 14320	92	10. 85680	10. 00416	2	9. 99584
56	. 13994	91	. 86006	. 14412	92	. 85588	. 00418	1	. 99582
57	. 14085	90	. 85915	. 14504	93	. 85496	. 00419	2	. 99581
58	. 14175	91	. 85825	. 14597	91	. 85403	. 00421	2	. 99579
59	. 14266	90	. 85734	. 14688	92	. 85312	. 00423	2	. 99577
60	9. 14356	90	10. 85644	9. 14780	92	10. 85220	10. 00425	2	9. 99575
↑ 97°→	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin ←82° ↑

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Logarithms of Trigonometric Functions

8° ↓	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos ←171° ↓
0	9. 14356	89	10. 85644	9. 14780	92	10. 85220	10. 00425	1	9. 99575
1	. 14445	90	. 85555	. 14872	91	. 85128	. 00426	2	. 99574
2	. 14535	89	. 85465	. 14963	91	. 85037	. 00428	2	. 99572
3	. 14624	90	. 85376	. 15054	91	. 84946	. 00430	2	. 99570
4	. 14714	89	. 85286	. 15145	91	. 84855	. 00432	2	. 99568
5	9. 14803	88	10. 85197	9. 15236	91	10. 84764	10. 00434	1	9. 99566
6	. 14891	89	. 85109	. 15327	90	. 84673	. 00435	2	. 99565
7	. 14980	89	. 85020	. 15417	91	. 84583	. 00437	2	. 99563
8	. 15069	89	. 84931	. 15508	90	. 84492	. 00439	2	. 99561
9	. 15157	88	. 84843	. 15598	90	. 84402	. 00441	2	. 99559
10	9. 15245	88	10. 84755	9. 15688	89	10. 84312	10. 00443	1	9. 99557
11	. 15333	88	. 84667	. 15777	90	. 84223	. 00444	2	. 99556
12	. 15421	88	. 84579	. 15867	90	. 84133	. 00446	2	. 99554
13	. 15508	87	. 84492	. 15956	89	. 84044	. 00448	2	. 99552
14	. 15596	88	. 84404	. 16046	90	. 83954	. 00450	2	. 99550
15	9. 15683	87	10. 84317	9. 16135	89	10. 83865	10. 00452	2	9. 99548
16	. 15770	87	. 84230	. 16224	88	. 83776	. 00454	1	. 99546
17	. 15857	87	. 84143	. 16312	88	. 83688	. 00455	2	. 99545
18	. 15944	87	. 84056	. 16401	89	. 83599	. 00457	2	. 99543
19	. 16030	86	. 83970	. 16489	88	. 83511	. 00459	2	. 99541
20	9. 16116	86	10. 83884	9. 16577	88	10. 83423	10. 00461	2	9. 99539
21	. 16203	87	. 83797	. 16665	88	. 83335	. 00463	2	. 99537
22	. 16289	86	. 83711	. 16753	88	. 83247	. 00465	2	. 99535
23	. 16374	85	. 83626	. 16841	88	. 83159	. 00467	2	. 99533
24	. 16460	86	. 83540	. 16928	87	. 83072	. 00468	1	. 99532
25	9. 16545	85	10. 83455	9. 17016	88	10. 82984	10. 00470	2	9. 99530
26	. 16631	86	. 83369	. 17103	87	. 82897	. 00472	2	. 99528
27	. 16716	85	. 83284	. 17190	87	. 82810	. 00474	2	. 99526
28	. 16801	85	. 83199	. 17277	87	. 82723	. 00476	2	. 99524
29	. 16886	85	. 83114	. 17363	86	. 82637	. 00478	2	. 99522
30	9. 16970	84	10. 83030	9. 17450	87	10. 82550	10. 00480	2	9. 99520
31	. 17055	85	. 82945	. 17536	86	. 82464	. 00482	1	. 99518
32	. 17139	84	. 82861	. 17622	86	. 82378	. 00483	2	. 99517
33	. 17223	84	. 82777	. 17708	86	. 82292	. 00485	2	. 99515
34	. 17307	84	. 82693	. 17794	86	. 82206	. 00487	2	. 99513
35	9. 17391	84	10. 82609	9. 17880	86	10. 82120	10. 00489	2	9. 99511
36	. 17474	83	. 82526	. 17965	85	. 82035	. 00491	2	. 99509
37	. 17558	84	. 82442	. 18051	86	. 81949	. 00493	2	. 99507
38	. 17641	83	. 82359	. 18136	85	. 81864	. 00495	2	. 99505
39	. 17724	83	. 82276	. 18221	85	. 81779	. 00497	2	. 99503
40	9. 17807	83	10. 82193	9. 18306	85	10. 81694	10. 00499	2	9. 99501
41	. 17890	83	. 82110	. 18391	84	. 81609	. 00501	2	. 99499
42	. 17973	82	. 82027	. 18475	85	. 81525	. 00503	2	. 99497
43	. 18055	82	. 81945	. 18560	84	. 81440	. 00505	2	. 99495
44	. 18137	83	. 81863	. 18644	84	. 81356	. 00506	1	. 99494
45	9. 18220	82	10. 81780	9. 18728	84	10. 81272	10. 00508	2	9. 99492
46	. 18302	81	. 81698	. 18812	84	. 81188	. 00510	2	. 99490
47	. 18383	82	. 81617	. 18896	83	. 81104	. 00512	2	. 99488
48	. 18465	82	. 81535	. 18979	84	. 81021	. 00514	2	. 99486
49	. 18547	81	. 81453	. 19063	83	. 80937	. 00516	2	. 99484
50	9. 18628	81	10. 81372	9. 19146	83	10. 80854	10. 00518	2	9. 99482
51	. 18709	81	. 81291	. 19229	83	. 80771	. 00520	2	. 99480
52	. 18790	81	. 81210	. 19312	83	. 80688	. 00522	2	. 99478
53	. 18871	81	. 81129	. 19395	83	. 80605	. 00524	2	. 99476
54	. 18952	81	. 81048	. 19478	83	. 80522	. 00526	2	. 99474
55	9. 19033	80	10. 80967	9. 19561	82	10. 80439	10. 00528	2	9. 99472
56	. 19113	80	. 80887	. 19643	82	. 80357	. 00530	2	. 99470
57	. 19193	80	. 80807	. 19725	82	. 80275	. 00532	2	. 99468
58	. 19273	80	. 80727	. 19807	82	. 80193	. 00534	2	. 99466
59	. 19353	80	. 80647	. 19889	82	. 80111	. 00536	2	. 99464
60	9. 19433	80	10. 80567	9. 19971	82	10. 80029	10. 00538	2	9. 99462
↑ 98°	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin ←81° ↑

Logarithms of Trigonometric Functions

1

9°→ ↓	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos ←170° ↓
0	9. 19433	80	10. 80567	9. 19971	82	10. 80029	10. 00538	2	9. 99462
1	. 19513	79	. 80487	. 20053	81	. 79947	. 00540	2	. 99460
2	. 19592	79	. 80408	. 20134	81	. 79866	. 00542	2	. 99458
3	. 19672	80	. 80328	. 20216	82	. 79784	. 00544	2	. 99456
4	. 19751	79	. 80249	. 20297	81	. 79703	. 00546	2	. 99454
5	9. 19830	79	10. 80170	9. 20378	81	10. 79622	10. 00548	2	9. 99452
6	. 19909	79	. 80091	. 20459	81	. 79541	. 00550	2	. 99450
7	. 19988	79	. 80012	. 20540	81	. 79460	. 00552	2	. 99448
8	. 20067	79	. 79933	. 20621	80	. 79379	. 00554	2	. 99446
9	. 20145	78	. 79855	. 20701	81	. 79299	. 00556	2	. 99444
10	9. 20223	78	10. 79777	9. 20782	80	10. 79218	10. 00558	2	9. 99442
11	. 20302	78	. 79698	. 20862	80	. 79138	. 00560	2	. 99440
12	. 20380	78	. 79620	. 20942	80	. 79058	. 00562	2	. 99438
13	. 20458	77	. 79542	. 21022	80	. 78978	. 00564	2	. 99436
14	. 20535	78	. 79465	. 21102	80	. 78898	. 00566	2	. 99434
15	9. 20613	78	10. 79387	9. 21182	79	10. 78818	10. 00568	3	9. 99432
16	. 20691	77	. 79309	. 21261	80	. 78739	. 00571	2	. 99429
17	. 20768	77	. 79232	. 21341	79	. 78659	. 00573	2	. 99427
18	. 20845	77	. 79155	. 21420	79	. 78580	. 00575	2	. 99425
19	. 20922	77	. 79078	. 21499	79	. 78501	. 00577	2	. 99423
20	9. 20999	77	10. 79001	9. 21578	79	10. 78422	10. 00579	2	9. 99421
21	. 21076	77	. 78924	. 21657	79	. 78343	. 00581	2	. 99419
22	. 21153	76	. 78847	. 21736	78	. 78264	. 00583	2	. 99417
23	. 21229	77	. 78771	. 21814	79	. 78186	. 00585	2	. 99415
24	. 21306	76	. 78694	. 21893	78	. 78107	. 00587	2	. 99413
25	9. 21382	76	10. 78618	9. 21971	78	10. 78029	10. 00589	2	9. 99411
26	. 21458	76	. 78542	. 22049	78	. 77951	. 00591	2	. 99409
27	. 21534	76	. 78466	. 22127	78	. 77873	. 00593	3	. 99407
28	. 21610	75	. 78390	. 22205	78	. 77795	. 00596	2	. 99404
29	. 21685	76	. 78315	. 22283	78	. 77717	. 00598	2	. 99402
30	9. 21761	75	10. 78239	9. 22361	77	10. 77639	10. 00600	2	9. 99400
31	. 21836	76	. 78164	. 22438	78	. 77562	. 00602	2	. 99398
32	. 21912	75	. 78088	. 22516	77	. 77484	. 00604	2	. 99396
33	. 21987	75	. 78013	. 22593	77	. 77407	. 00606	2	. 99394
34	. 22062	75	. 77938	. 22670	77	. 77330	. 00608	2	. 99392
35	9. 22137	74	10. 77863	9. 22747	77	10. 77253	10. 00610	2	9. 99390
36	. 22211	75	. 77789	. 22824	77	. 77176	. 00612	3	. 99388
37	. 22286	75	. 77714	. 22901	76	. 77099	. 00615	2	. 99385
38	. 22361	74	. 77639	. 22977	77	. 77023	. 00617	2	. 99383
39	. 22435	74	. 77565	. 23054	76	. 76946	. 00619	2	. 99381
40	9. 22509	74	10. 77491	9. 23130	76	10. 76870	10. 00621	2	9. 99379
41	. 22583	74	. 77417	. 23206	77	. 76794	. 00623	2	. 99377
42	. 22657	74	. 77343	. 23283	76	. 76717	. 00625	3	. 99375
43	. 22731	74	. 77269	. 23359	76	. 76641	. 00628	2	. 99372
44	. 22805	73	. 77195	. 23435	75	. 76565	. 00630	2	. 99370
45	9. 22878	74	10. 77122	9. 23510	76	10. 76490	10. 00632	2	9. 99368
46	. 22952	73	. 77048	. 23586	75	. 76414	. 00634	2	. 99366
47	. 23025	73	. 76975	. 23661	76	. 76339	. 00636	2	. 99364
48	. 23098	73	. 76902	. 23737	75	. 76263	. 00638	3	. 99362
49	. 23171	73	. 76829	. 23812	75	. 76188	. 00641	2	. 99359
50	9. 23244	73	10. 76756	9. 23887	75	10. 76113	10. 00643	2	9. 99357
51	. 23317	73	. 76683	. 23962	75	. 76038	. 00645	2	. 99355
52	. 23390	72	. 76610	. 24037	75	. 75963	. 00647	2	. 99353
53	. 23462	73	. 76538	. 24112	74	. 75888	. 00649	3	. 99351
54	. 23535	72	. 76465	. 24186	75	. 75814	. 00652	2	. 99348
55	9. 23607	72	10. 76393	9. 24261	74	10. 75739	10. 00654	2	9. 99346
56	. 23679	73	. 76321	. 24335	75	. 75665	. 00656	2	. 99344
57	. 23752	71	. 76248	. 24410	74	. 75590	. 00658	2	. 99342
58	. 23823	72	. 76177	. 24484	74	. 75516	. 00660	3	. 99340
59	. 23895	72	. 76105	. 24558	74	. 75442	. 00663	2	. 99337
60	9. 23967	72	10. 76033	9. 24632	74	10. 75368	10. 00665	2	9. 99335
↑ 99°→	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin ←80° ↑

1

Logarithms of Trigonometric Functions

10° →	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos ← 169°	
0	9. 23967	72	10. 76033	9. 24632	74	10. 75368	10. 00665	2	9. 99335	60
1	. 24039	71	. 75961	. 24706	73	. 75294	. 00667	2	. 99333	59
2	. 24110	71	. 75890	. 24779	74	. 75221	. 00669	2	. 99331	58
3	. 24181	71	. 75819	. 24853	73	. 75147	. 00672	2	. 99328	57
4	. 24253	71	. 75747	. 24926	74	. 75074	. 00674	2	. 99326	56
5	9. 24324	71	10. 75676	9. 25000	73	10. 75000	10. 00676	2	9. 99324	55
6	. 24395	71	. 75605	. 25073	73	. 74927	. 00678	3	. 99322	54
7	. 24466	70	. 75534	. 25146	73	. 74854	. 00681	2	. 99319	53
8	. 24536	71	. 75464	. 25219	73	. 74781	. 00683	2	. 99317	52
9	. 24607	70	. 75393	. 25292	73	. 74708	. 00685	2	. 99315	51
10	9. 24677	71	10. 75323	9. 25365	72	10. 74635	10. 00687	3	9. 99313	50
11	. 24748	70	. 75252	. 25437	73	. 74563	. 00690	2	. 99310	49
12	. 24818	70	. 75182	. 25510	72	. 74490	. 00692	2	. 99308	48
13	. 24888	70	. 75112	. 25582	73	. 74418	. 00694	2	. 99306	47
14	. 24958	70	. 75042	. 25655	72	. 74345	. 00696	3	. 99304	46
15	9. 25028	70	10. 74972	9. 25727	72	10. 74273	10. 00699	2	9. 99301	45
16	. 25098	70	. 74902	. 25799	72	. 74201	. 00701	2	. 99299	44
17	. 25168	69	. 74832	. 25871	72	. 74129	. 00703	2	. 99297	43
18	. 25237	70	. 74763	. 25943	72	. 74057	. 00706	2	. 99294	42
19	. 25307	69	. 74693	. 26015	71	. 73985	. 00708	2	. 99292	41
20	9. 25376	69	10. 74624	9. 26086	72	10. 73914	10. 00710	2	9. 99290	40
21	. 25445	69	. 74555	. 26158	71	. 73842	. 00712	3	. 99288	39
22	. 25514	69	. 74486	. 26229	71	. 73771	. 00715	2	. 99285	38
23	. 25583	69	. 74417	. 26301	72	. 73699	. 00717	2	. 99283	37
24	. 25652	69	. 74348	. 26372	71	. 73628	. 00719	3	. 99281	36
25	9. 25721	69	10. 74279	9. 26443	71	10. 73557	10. 00722	2	9. 99278	35
26	. 25790	68	. 74210	. 26514	71	. 73486	. 00724	2	. 99276	34
27	. 25858	69	. 74142	. 26585	71	. 73415	. 00726	3	. 99274	33
28	. 25927	68	. 74073	. 26655	70	. 73345	. 00729	2	. 99271	32
29	. 25995	68	. 74005	. 26726	71	. 73274	. 00731	2	. 99269	31
30	9. 26063	68	10. 73937	9. 26797	70	10. 73203	10. 00733	3	9. 99267	30
31	. 26131	68	. 73869	. 26867	70	. 73133	. 00736	2	. 99264	29
32	. 26199	68	. 73801	. 26937	71	. 73063	. 00738	2	. 99262	28
33	. 26267	68	. 73733	. 27008	70	. 72992	. 00740	3	. 99260	27
34	. 26335	68	. 73665	. 27078	70	. 72922	. 00743	2	. 99257	26
35	9. 26403	67	10. 73597	9. 27148	70	10. 72852	10. 00745	3	9. 99255	25
36	. 26470	68	. 73530	. 27218	70	. 72782	. 00748	2	. 99252	24
37	. 26538	67	. 73462	. 27288	69	. 72712	. 00750	2	. 99250	23
38	. 26605	67	. 73395	. 27357	70	. 72643	. 00752	3	. 99248	22
39	. 26672	67	. 73328	. 27427	69	. 72573	. 00755	2	. 99245	21
40	9. 26739	67	10. 73261	9. 27496	70	10. 72504	10. 00757	2	9. 99243	20
41	. 26806	67	. 73194	. 27566	69	. 72434	. 00759	3	. 99241	19
42	. 26873	67	. 73127	. 27635	69	. 72365	. 00762	2	. 99238	18
43	. 26940	67	. 73060	. 27704	69	. 72296	. 00764	3	. 99236	17
44	. 27007	66	. 72993	. 27773	69	. 72227	. 00767	2	. 99233	16
45	9. 27073	67	10. 72927	9. 27842	69	10. 72158	10. 00769	2	9. 99231	15
46	. 27140	66	. 72860	. 27911	69	. 72089	. 00771	3	. 99229	14
47	. 27206	67	. 72794	. 27980	69	. 72020	. 00774	2	. 99226	13
48	. 27273	66	. 72727	. 28049	68	. 71951	. 00776	3	. 99224	12
49	. 27339	66	. 72661	. 28117	69	. 71883	. 00779	2	. 99221	11
50	9. 27405	66	10. 72595	9. 28186	68	10. 71814	10. 00781	2	9. 99219	10
51	. 27471	66	. 72529	. 28254	69	. 71746	. 00783	3	. 99217	9
52	. 27537	65	. 72463	. 28323	68	. 71677	. 00786	2	. 99214	8
53	. 27602	66	. 72398	. 28391	68	. 71609	. 00788	3	. 99212	7
54	. 27668	66	. 72332	. 28459	68	. 71541	. 00791	2	. 99209	6
55	9. 27734	65	10. 72266	9. 28527	68	10. 71473	10. 00793	3	9. 99207	5
56	. 27799	65	. 72201	. 28595	67	. 71405	. 00796	2	. 99204	4
57	. 27864	66	. 72136	. 28662	68	. 71338	. 00798	2	. 99202	3
58	. 27930	65	. 72070	. 28730	68	. 71270	. 00800	3	. 99200	2
59	. 27995	65	. 72005	. 28798	67	. 71202	. 00803	2	. 99197	1
60	9. 28060	65	10. 71940	9. 28865	67	10. 71135	10. 00805	2	9. 99195	0
↑ 100° →	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin ← 79°	

Logarithms of Trigonometric Functions

1

11° ↓	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos ←168° ↓
0	9. 28060	65	10. 71940	9. 28865	68	10. 71135	10. 00805	3	9. 99195
1	. 28125	65	. 71875	. 28933	67	. 71067	. 00808	2	. 99192
2	. 28190	64	. 71810	. 29000	67	. 71000	. 00810	3	. 99190
3	. 28254	65	. 71746	. 29067	67	. 70933	. 00813	2	. 99187
4	. 28319	65	. 71681	. 29134	67	. 70866	. 00815	3	. 99185
5	9. 28384	64	10. 71616	9. 29201	67	10. 70799	10. 00818	2	9. 99182
6	. 28448	64	. 71552	. 29268	67	. 70732	. 00820	3	. 99180
7	. 28512	65	. 71488	. 29335	67	. 70665	. 00823	2	. 99177
8	. 28577	64	. 71423	. 29402	66	. 70598	. 00825	3	. 99175
9	. 28641	64	. 71359	. 29468	67	. 70532	. 00828	2	. 99172
10	9. 28705	64	10. 71295	9. 29535	66	10. 70465	10. 00830	3	9. 99170
11	. 28769	64	. 71231	. 29601	67	. 70399	. 00833	2	. 99167
12	. 28833	63	. 71167	. 29668	66	. 70332	. 00835	3	. 99165
13	. 28896	64	. 71104	. 29734	66	. 70266	. 00838	2	. 99162
14	. 28960	64	. 71040	. 29800	66	. 70200	. 00840	3	. 99160
15	9. 29024	63	10. 70976	9. 29866	66	10. 70134	10. 00843	2	9. 99157
16	. 29087	63	. 70913	. 29932	66	. 70068	. 00845	3	. 99155
17	. 29150	64	. 70850	. 29998	66	. 70002	. 00848	2	. 99152
18	. 29214	63	. 70786	. 30064	66	. 69936	. 00850	3	. 99150
19	. 29277	63	. 70723	. 30130	65	. 69870	. 00853	2	. 99147
20	9. 29340	63	10. 70660	9. 30195	66	10. 69805	10. 00855	3	9. 99145
21	. 29403	63	. 70597	. 30261	65	. 69739	. 00858	2	. 99142
22	. 29466	63	. 70534	. 30326	65	. 69674	. 00860	3	. 99140
23	. 29529	62	. 70471	. 30391	66	. 69609	. 00863	2	. 99137
24	. 29591	63	. 70409	. 30457	65	. 69543	. 00865	3	. 99135
25	9. 29654	62	10. 70346	9. 30522	65	10. 69478	10. 00868	2	9. 99132
26	. 29716	63	. 70284	. 30587	65	. 69413	. 00870	3	. 99130
27	. 29779	62	. 70221	. 30652	65	. 69348	. 00873	2	. 99127
28	. 29841	62	. 70159	. 30717	65	. 69283	. 00876	3	. 99124
29	. 29903	63	. 70097	. 30782	64	. 69218	. 00878	2	. 99122
30	9. 29966	62	10. 70034	9. 30846	65	10. 69154	10. 00881	3	9. 99119
31	. 30028	62	. 69972	. 30911	64	. 69089	. 00883	2	. 99117
32	. 30090	61	. 69910	. 30975	65	. 69025	. 00886	3	. 99114
33	. 30151	62	. 69849	. 31040	64	. 68960	. 00888	2	. 99112
34	. 30213	62	. 69787	. 31104	64	. 68896	. 00891	3	. 99109
35	9. 30275	61	10. 69725	9. 31168	65	10. 68832	10. 00894	2	9. 99106
36	. 30336	62	. 69664	. 31233	64	. 68767	. 00896	3	. 99104
37	. 30398	61	. 69602	. 31297	64	. 68703	. 00899	2	. 99101
38	. 30459	62	. 69541	. 31361	64	. 68639	. 00901	3	. 99099
39	. 30521	61	. 69479	. 31425	64	. 68575	. 00904	2	. 99096
40	9. 30582	61	10. 69418	9. 31489	63	10. 68511	10. 00907	3	9. 99093
41	. 30643	61	. 69357	. 31552	64	. 68448	. 00909	2	. 99091
42	. 30704	61	. 69296	. 31616	63	. 68384	. 00912	3	. 99088
43	. 30765	61	. 69235	. 31679	64	. 68321	. 00914	2	. 99086
44	. 30826	61	. 69174	. 31743	63	. 68257	. 00917	3	. 99083
45	9. 30887	60	10. 69113	9. 31806	64	10. 68194	10. 00920	2	9. 99080
46	. 30947	61	. 69053	. 31870	63	. 68130	. 00922	3	. 99078
47	. 31008	60	. 68992	. 31933	63	. 68067	. 00925	2	. 99075
48	. 31068	61	. 68932	. 31996	63	. 68004	. 00928	3	. 99072
49	. 31129	60	. 68871	. 32059	63	. 67941	. 00930	2	. 99070
50	9. 31189	61	10. 68811	9. 32122	63	10. 67878	10. 00933	3	9. 99067
51	. 31250	60	. 68750	. 32185	63	. 67815	. 00936	2	. 99064
52	. 31310	60	. 68690	. 32248	63	. 67752	. 00938	3	. 99062
53	. 31370	60	. 68630	. 32311	62	. 67689	. 00941	2	. 99059
54	. 31430	60	. 68570	. 32373	63	. 67627	. 00944	3	. 99056
55	9. 31490	59	10. 68510	9. 32436	62	10. 67564	10. 00946	2	9. 99054
56	. 31549	60	. 68451	. 32498	63	. 67502	. 00949	3	. 99051
57	. 31609	60	. 68391	. 32561	62	. 67439	. 00952	2	. 99048
58	. 31669	59	. 68331	. 32623	62	. 67377	. 00954	3	. 99046
59	. 31728	60	. 68272	. 32685	62	. 67315	. 00957	2	. 99043
60	9. 31788	60	10. 68212	9. 32747	62	10. 67253	10. 00960	3	9. 99040
↑101°	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin ←78° ↑

<div> <div>1</div> <div>12°-20'</div> <div>Logarithms of Trigonometric Functions</div> </div>									
12°	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos +167°
0	9. 31788	59	10. 68212	9. 32747	63	10. 67253	10. 00960	2	9. 99040
1	31847	60	68153	32810	62	67190	00962	3	99038
2	31907	59	68093	32872	61	67128	00965	3	99035
3	31966	59	68034	32933	61	67067	00968	2	99032
4	32025	59	67975	32995	62	67005	00970	3	99030
5	9. 32084	59	10. 67916	9. 33057	62	10. 66943	10. 00973	3	9. 99027
6	32143	59	67857	33119	61	66881	00976	2	99024
7	32202	59	67798	33180	62	66820	00978	3	99022
8	32261	58	67739	33242	61	66758	00981	3	99019
9	32319	59	67681	33303	62	66697	00984	3	99016
10	9. 32378	59	10. 67622	9. 33365	61	10. 66635	10. 00987	2	9. 99013
11	32437	58	67563	33426	61	66574	00989	3	99011
12	32495	58	67505	33487	61	66513	00992	3	99008
13	32553	59	67447	33548	61	66452	00995	3	99005
14	32612	58	67388	33609	61	66391	00998	2	99002
15	9. 32670	58	10. 67330	9. 33670	61	10. 66330	10. 01000	3	9. 99000
16	32728	58	67272	33731	61	66269	01003	3	98997
17	32786	58	67214	33792	61	66208	01006	3	98994
18	32844	58	67156	33853	60	66147	01009	2	98991
19	32902	58	67098	33913	61	66087	01011	3	98989
20	9. 32960	58	10. 67040	9. 33974	60	10. 66026	10. 01014	3	9. 98986
21	33018	57	66982	34034	61	65966	01017	3	98983
22	33075	58	66925	34095	60	65905	01020	2	98980
23	33133	57	66867	34155	60	65845	01022	3	98978
24	33190	58	66810	34215	61	65785	01025	3	98975
25	9. 33248	57	10. 66752	9. 34276	60	10. 65724	10. 01028	3	9. 98972
26	33305	57	66695	34336	60	65664	01031	2	98969
27	33362	58	66638	34396	60	65604	01033	3	98967
28	33420	57	66580	34456	60	65544	01036	3	98964
29	33477	57	66523	34516	60	65484	01039	3	98961
30	9. 33534	57	10. 66466	9. 34576	59	10. 65424	10. 01042	3	9. 98958
31	33591	56	66409	34635	60	65365	01045	2	98955
32	33647	57	66353	34695	60	65305	01047	3	98953
33	33704	57	66296	34755	59	65245	01050	3	98950
34	33761	57	66239	34814	60	65186	01053	3	98947
35	9. 33818	56	10. 66182	9. 34874	59	10. 65126	10. 01056	3	9. 98944
36	33874	57	66126	34933	59	65067	01059	3	98941
37	33931	56	66069	34992	59	65008	01062	2	98938
38	33987	56	66013	35051	59	64949	01064	3	98936
39	34043	57	65957	35111	60	64889	01067	3	98933
40	9. 34100	56	10. 65900	9. 35170	59	10. 64830	10. 01070	3	9. 98930
41	34156	56	65844	35229	59	64771	01073	3	98927
42	34212	56	65788	35288	59	64712	01076	3	98924
43	34268	56	65732	35347	58	64653	01079	2	98921
44	34324	56	65676	35405	59	64595	01081	3	98919
45	9. 34380	56	10. 65620	9. 35464	59	10. 64536	10. 01084	3	9. 98916
46	34436	55	65564	35523	58	64477	01087	3	98913
47	34491	56	65509	35581	59	64419	01090	3	98910
48	34547	55	65453	35640	58	64360	01093	3	98907
49	34602	56	65398	35698	59	64302	01096	3	98904
50	9. 34658	55	10. 65342	9. 35757	58	10. 64243	10. 01099	3	9. 98901
51	34713	56	65287	35815	58	64185	01102	2	98898
52	34769	55	65231	35873	58	64127	01104	3	98896
53	34824	55	65176	35931	58	64069	01107	3	98893
54	34879	55	65121	35989	58	64011	01110	3	98890
55	9. 34934	55	10. 65066	9. 36047	58	10. 63953	10. 01113	3	9. 98887
56	34989	55	65011	36105	58	63895	01116	3	98884
57	35044	55	64956	36163	58	63837	01119	3	98881
58	35099	55	64901	36221	58	63779	01122	3	98878
59	35154	55	64846	36279	58	63721	01125	3	98875
60	9. 35209	55	10. 64791	9. 36336	57	10. 63664	10. 01128	3	9. 98872
102°	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin +77°

Logarithms of Trigonometric Functions

1

13°→		sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos	-166° ↓
0	9. 35209			10. 64791	9. 36336		10. 63664	10. 01128		9. 98872	60
1	35263	54		64737	36394	58	63606	01131		98869	59
2	35318	55		64682	36452	58	63548	01133		98867	58
3	35373	55		64627	36509	57	63491	01136		98864	57
4	35427	54		64573	36566	57	63434	01139		98861	56
5	9. 35481	54		10. 64519	9. 36624	58	10. 63376	10. 01142		9. 98858	55
6	35536	55		64464	36681	57	63319	01145		98855	54
7	35590	54		64410	36738	57	63262	01148		98852	53
8	35644	54		64356	36795	57	63205	01151		98849	52
9	35698	54		64302	36852	57	63148	01154		98846	51
10	9. 35752	54		10. 64248	9. 36909	57	10. 63091	10. 01157		9. 98843	50
11	35806	54		64194	36966	57	63034	01160		98840	49
12	35860	54		64140	37023	57	62977	01163		98837	48
13	35914	54		64086	37080	57	62920	01166		98834	47
14	35968	54		64032	37137	57	62863	01169		98831	46
15	9. 36022	53		10. 63978	9. 37193	56	10. 62807	10. 01172		9. 98828	45
16	36075	53		63925	37250	57	62750	01175		98825	44
17	36129	54		63871	37306	56	62694	01178		98822	43
18	36182	53		63818	37363	57	62637	01181		98819	42
19	36236	54		63764	37419	56	62581	01184		98816	41
20	9. 36289	53		10. 63711	9. 37476	57	10. 62524	10. 01187		9. 98813	40
21	36342	53		63658	37532	56	62468	01190		98810	39
22	36395	53		63605	37588	56	62412	01193		98807	38
23	36449	54		63551	37644	56	62356	01196		98804	37
24	36502	53		63498	37700	56	62300	01199		98801	36
25	9. 36555	53		10. 63445	9. 37756	56	10. 62244	10. 01202		9. 98798	35
26	36608	52		63392	37812	56	62188	01205		98795	34
27	36660	52		63340	37868	56	62132	01208		98792	33
28	36713	53		63287	37924	56	62076	01211		98789	32
29	36766	53		63234	37980	55	62020	01214		98786	31
30	9. 36819	52		10. 63181	9. 38035	56	10. 61965	10. 01217		9. 98783	30
31	36871	53		63129	38091	56	61909	01220		98780	29
32	36924	53		63076	38147	56	61853	01223		98777	28
33	36976	52		63024	38202	55	61798	01226		98774	27
34	37028	52		62972	38257	55	61743	01229		98771	26
35	9. 37081	53		10. 62919	9. 38313	56	10. 61687	10. 01232		9. 98768	25
36	37133	52		62867	38368	55	61632	01235		98765	24
37	37185	52		62815	38423	55	61577	01238		98762	23
38	37237	52		62763	38479	56	61521	01241		98759	22
39	37289	52		62711	38534	55	61466	01244		98756	21
40	9. 37341	52		10. 62659	9. 38589	55	10. 61411	10. 01247		9. 98753	20
41	37393	52		62607	38644	55	61356	01250		98750	19
42	37445	52		62555	38699	55	61301	01254		98746	18
43	37497	52		62503	38754	55	61246	01257		98743	17
44	37549	52		62451	38808	54	61192	01260		98740	16
45	9. 37600	51		10. 62400	9. 38863	55	10. 61137	10. 01263		9. 98737	15
46	37652	52		62348	38918	55	61082	01266		98734	14
47	37703	51		62297	38972	54	61028	01269		98731	13
48	37755	52		62245	39027	55	60973	01272		98728	12
49	37806	51		62194	39082	55	60918	01275		98725	11
50	9. 37858	52		10. 62142	9. 39136	54	10. 60864	10. 01278		9. 98722	10
51	37909	51		62091	39190	54	60810	01281		98719	9
52	37960	51		62040	39245	55	60755	01285		98715	8
53	38011	51		61989	39299	54	60701	01288		98712	7
54	38062	51		61938	39353	54	60647	01291		98709	6
55	9. 38113	51		10. 61887	9. 39407	54	10. 60593	10. 01294		9. 98706	5
56	38164	51		61836	39461	54	60539	01297		98703	4
57	38215	51		61785	39515	54	60485	01300		98700	3
58	38266	51		61734	39569	54	60431	01303		98697	2
59	38317	51		61683	39623	54	60377	01306		98694	1
60	9. 38368	51		10. 61632	9. 39677	54	10. 60323	10. 01310		9. 98690	0
↑103°→	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin	-76° ↑	

1

Logarithms of Trigonometric Functions

14°	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos	+165°
0	9. 38368	50	10. 61632	9. 39677	54	10. 60323	10. 01310	3	9. 98690	60
1	38418	51	61582	39731	54	60269	01313	3	98687	59
2	38469	50	61531	39785	53	60215	01316	3	98684	58
3	38519	51	61481	39838	54	60162	01319	3	98681	57
4	38570	50	61430	39892	53	60108	01322	3	98678	56
5	9. 38620	50	10. 61380	9. 39945	54	10. 60055	10. 01325	4	9. 98675	55
6	38670	51	61330	39999	53	60001	01329	3	98671	54
7	38721	50	61279	40052	54	59948	01332	3	98668	53
8	38771	50	61229	40106	53	59894	01335	3	98665	52
9	38821	50	61179	40159	53	59841	01338	3	98662	51
10	9. 38871	50	10. 61129	9. 40212	54	10. 59788	10. 01341	3	9. 98659	50
11	38921	50	61079	40266	53	59734	01344	4	98656	49
12	38971	50	61029	40319	53	59681	01348	3	98652	48
13	39021	50	60979	40372	53	59628	01351	3	98649	47
14	39071	50	60929	40425	53	59575	01354	3	98646	46
15	9. 39121	49	10. 60879	9. 40478	53	10. 59522	10. 01357	3	9. 98643	45
16	39170	50	60830	40531	53	59469	01360	4	98640	44
17	39220	50	60780	40584	52	59416	01364	3	98636	43
18	39270	49	60730	40636	53	59364	01367	3	98633	42
19	39319	50	60681	40689	53	59311	01370	3	98630	41
20	9. 39369	49	10. 60631	9. 40742	53	10. 59258	10. 01373	4	9. 98627	40
21	39418	49	60582	40795	52	59205	01377	3	98623	39
22	39467	50	60533	40847	53	59153	01380	3	98620	38
23	39517	49	60483	40900	52	59100	01383	3	98617	37
24	39566	49	60434	40952	53	59048	01386	4	98614	36
25	9. 39615	49	10. 60385	9. 41005	52	10. 58995	10. 01390	3	9. 98610	35
26	39664	49	60336	41057	52	58943	01393	3	98607	34
27	39713	49	60287	41109	52	58891	01396	3	98604	33
28	39762	49	60238	41161	53	58839	01399	4	98601	32
29	39811	49	60189	41214	52	58786	01403	3	98597	31
30	9. 39860	49	10. 60140	9. 41266	52	10. 58734	10. 01406	3	9. 98594	30
31	39909	49	60091	41318	52	58682	01409	3	98591	29
32	39958	48	60042	41370	52	58630	01412	4	98588	28
33	40006	49	59994	41422	52	58578	01416	3	98584	27
34	40055	48	59945	41474	52	58526	01419	3	98581	26
35	9. 40103	48	10. 59897	9. 41526	52	10. 58474	10. 01422	4	9. 98578	25
36	40152	48	59848	41578	51	58422	01426	3	98574	24
37	40200	49	59800	41629	52	58371	01429	3	98571	23
38	40249	48	59751	41681	52	58319	01432	3	98568	22
39	40297	49	59703	41733	51	58267	01435	4	98565	21
40	9. 40346	48	10. 59654	9. 41784	52	10. 58216	10. 01439	3	9. 98561	20
41	40394	48	59606	41836	51	58164	01442	3	98558	19
42	40442	48	59558	41887	52	58113	01445	4	98555	18
43	40490	48	59510	41939	51	58061	01449	3	98551	17
44	40538	48	59462	41990	51	58010	01452	3	98548	16
45	9. 40586	48	10. 59414	9. 42041	52	10. 57959	10. 01455	4	9. 98545	15
46	40634	48	59366	42093	51	57907	01459	3	98541	14
47	40682	48	59318	42144	51	57856	01462	3	98538	13
48	40730	48	59270	42195	51	57805	01465	4	98535	12
49	40778	47	59222	42246	51	57754	01469	3	98531	11
50	9. 40825	48	10. 59175	9. 42297	51	10. 57703	10. 01472	3	9. 98528	10
51	40873	48	59127	42348	51	57652	01475	4	98525	9
52	40921	47	59079	42399	51	57601	01479	3	98521	8
53	40968	48	59032	42450	51	57550	01482	3	98518	7
54	41016	47	58984	42501	51	57499	01485	4	98515	6
55	9. 41063	48	10. 58937	9. 42552	51	10. 57448	10. 01489	3	9. 98511	5
56	41111	47	58889	42603	50	57397	01492	3	98508	4
57	41158	47	58842	42653	51	57347	01495	4	98505	3
58	41205	47	58795	42704	51	57296	01499	3	98501	2
59	41252	47	58748	42755	51	57245	01502	4	98498	1
60	9. 41300	48	10. 58700	9. 42805	50	10. 57195	10. 01506	4	9. 98494	0
104°	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin	+75°

Logarithms of Trigonometric Functions

1

15°→	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos	+164°
0	9. 41300	47	10. 58700	9. 42805	51	10. 57195	10. 01506	3	9. 98494	60
1	. 41347	47	. 58653	. 42856	50	. 57144	. 01509	3	. 98491	59
2	. 41394	47	. 58606	. 42906	51	. 57094	. 01512	3	. 98488	58
3	. 41441	47	. 58559	. 42957	50	. 57043	. 01516	4	. 98484	57
4	. 41488	47	. 58512	. 43007	50	. 56993	. 01519	4	. 98481	56
5	9. 41535	47	10. 58465	9. 43057	51	10. 56943	10. 01523	3	9. 98477	55
6	. 41582	46	. 58418	. 43108	50	. 56892	. 01526	3	. 98474	54
7	. 41628	47	. 58372	. 43158	50	. 56842	. 01529	3	. 98471	53
8	. 41675	47	. 58325	. 43208	50	. 56792	. 01533	4	. 98467	52
9	. 41722	46	. 58278	. 43258	50	. 56742	. 01536	4	. 98464	51
10	9. 41768	47	10. 58232	9. 43308	50	10. 56692	10. 01540	3	9. 98460	50
11	. 41815	46	. 58185	. 43358	50	. 56642	. 01543	4	. 98457	49
12	. 41861	47	. 58139	. 43408	50	. 56592	. 01547	3	. 98453	48
13	. 41908	46	. 58092	. 43458	50	. 56542	. 01550	3	. 98450	47
14	. 41954	47	. 58046	. 43508	50	. 56492	. 01553	4	. 98447	46
15	9. 42001	46	10. 57999	9. 43558	49	10. 56442	10. 01557	3	9. 98443	45
16	. 42047	46	. 57953	. 43607	50	. 56393	. 01560	4	. 98440	44
17	. 42093	47	. 57907	. 43657	50	. 56343	. 01564	3	. 98436	43
18	. 42140	46	. 57860	. 43707	49	. 56293	. 01567	4	. 98433	42
19	. 42186	46	. 57814	. 43756	50	. 56244	. 01571	3	. 98429	41
20	9. 42232	46	10. 57768	9. 43806	49	10. 56194	10. 01574	4	9. 98426	40
21	. 42278	46	. 57722	. 43855	50	. 56145	. 01578	3	. 98422	39
22	. 42324	46	. 57676	. 43905	49	. 56095	. 01581	4	. 98419	38
23	. 42370	46	. 57630	. 43954	50	. 56046	. 01585	3	. 98415	37
24	. 42416	45	. 57584	. 44004	49	. 55996	. 01588	3	. 98412	36
25	9. 42461	46	10. 57539	9. 44053	49	10. 55947	10. 01591	4	9. 98409	35
26	. 42507	46	. 57493	. 44102	49	. 55898	. 01595	3	. 98405	34
27	. 42553	46	. 57447	. 44151	50	. 55849	. 01598	4	. 98402	33
28	. 42599	45	. 57401	. 44201	49	. 55799	. 01602	3	. 98398	32
29	. 42644	46	. 57356	. 44250	49	. 55750	. 01605	4	. 98395	31
30	9. 42690	45	10. 57310	9. 44299	49	10. 55701	10. 01609	3	9. 98391	30
31	. 42735	46	. 57265	. 44348	49	. 55652	. 01612	4	. 98388	29
32	. 42781	45	. 57219	. 44397	49	. 55603	. 01616	3	. 98384	28
33	. 42826	46	. 57174	. 44446	49	. 55554	. 01619	4	. 98381	27
34	. 42872	45	. 57128	. 44495	49	. 55505	. 01623	4	. 98377	26
35	9. 42917	45	10. 57083	9. 44544	48	10. 55456	10. 01627	3	9. 98373	25
36	. 42962	46	. 57038	. 44592	49	. 55408	. 01630	4	. 98370	24
37	. 43008	45	. 56992	. 44641	49	. 55359	. 01634	3	. 98366	23
38	. 43053	45	. 56947	. 44690	48	. 55310	. 01637	4	. 98363	22
39	. 43098	45	. 56902	. 44738	49	. 55262	. 01641	3	. 98359	21
40	9. 43143	45	10. 56857	9. 44787	49	10. 55213	10. 01644	4	9. 98356	20
41	. 43188	45	. 56812	. 44836	48	. 55164	. 01648	3	. 98352	19
42	. 43233	45	. 56767	. 44884	49	. 55116	. 01651	4	. 98349	18
43	. 43278	45	. 56722	. 44933	48	. 55067	. 01655	3	. 98345	17
44	. 43323	44	. 56677	. 44981	48	. 55019	. 01658	4	. 98342	16
45	9. 43367	45	10. 56633	9. 45029	49	10. 54971	10. 01662	4	9. 98338	15
46	. 43412	45	. 56588	. 45078	48	. 54922	. 01666	3	. 98334	14
47	. 43457	45	. 56543	. 45126	48	. 54874	. 01669	4	. 98331	13
48	. 43502	44	. 56498	. 45174	48	. 54826	. 01673	3	. 98327	12
49	. 43546	45	. 56454	. 45222	49	. 54778	. 01676	4	. 98324	11
50	9. 43591	44	10. 56409	9. 45271	48	10. 54729	10. 01680	3	9. 98320	10
51	. 43635	45	. 56365	. 45319	48	. 54681	. 01683	4	. 98317	9
52	. 43680	44	. 56320	. 45367	48	. 54633	. 01687	3	. 98313	8
53	. 43724	45	. 56276	. 45415	48	. 54585	. 01691	4	. 98309	7
54	. 43769	44	. 56231	. 45463	48	. 54537	. 01694	4	. 98306	6
55	9. 43813	44	10. 56187	9. 45511	48	10. 54489	10. 01698	3	9. 98302	5
56	. 43857	44	. 56143	. 45559	47	. 54441	. 01701	4	. 98299	4
57	. 43901	45	. 56099	. 45606	48	. 54394	. 01705	3	. 98295	3
58	. 43946	44	. 56054	. 45654	48	. 54346	. 01709	4	. 98291	2
59	. 43990	44	. 56010	. 45702	48	. 54298	. 01712	4	. 98288	1
60	9. 44034	44	10. 55966	9. 45750	48	10. 54250	10. 01716	4	9. 98284	0
↑105°→	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin	+74°

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Logarithms of Trigonometric Functions

16° ↓	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos	163° ↓
0	9. 44034	44	10. 55966	9. 45750	47	10. 54250	10. 01716	3	9. 98284	60
1	. 44078	44	. 55922	. 45797	48	. 54203	. 01719	4	. 98281	59
2	. 44122	44	. 55878	. 45845	47	. 54155	. 01723	4	. 98277	58
3	. 44166	44	. 55834	. 45892	48	. 54108	. 01727	4	. 98273	57
4	. 44210	43	. 55790	. 45940	47	. 54060	. 01730	4	. 98270	56
5	9. 44253	44	10. 55747	9. 45987	48	10. 54013	10. 01734	4	9. 98266	55
6	. 44297	44	. 55703	. 46035	47	. 53965	. 01738	3	. 98262	54
7	. 44341	44	. 55659	. 46082	48	. 53918	. 01741	4	. 98259	53
8	. 44385	43	. 55615	. 46130	47	. 53870	. 01745	4	. 98255	52
9	. 44428	44	. 55572	. 46177	47	. 53823	. 01749	3	. 98251	51
10	9. 44472	44	10. 55528	9. 46224	47	10. 53776	10. 01752	4	9. 98248	50
11	. 44516	43	. 55484	. 46271	48	. 53729	. 01756	4	. 98244	49
12	. 44559	43	. 55441	. 46319	47	. 53681	. 01760	3	. 98240	48
13	. 44602	44	. 55398	. 46366	47	. 53634	. 01763	4	. 98237	47
14	. 44646	43	. 55354	. 46413	47	. 53587	. 01767	4	. 98233	46
15	9. 44689	44	10. 55311	9. 46460	47	10. 53540	10. 01771	3	9. 98229	45
16	. 44733	43	. 55267	. 46507	47	. 53493	. 01774	4	. 98226	44
17	. 44776	43	. 55224	. 46554	47	. 53446	. 01778	4	. 98222	43
18	. 44819	43	. 55181	. 46601	47	. 53399	. 01782	3	. 98218	42
19	. 44862	43	. 55138	. 46648	46	. 53352	. 01785	4	. 98215	41
20	9. 44905	43	10. 55095	9. 46694	47	10. 53306	10. 01789	4	9. 98211	40
21	. 44948	44	. 55052	. 46741	47	. 53259	. 01793	3	. 98207	39
22	. 44992	43	. 55008	. 46788	47	. 53212	. 01796	4	. 98204	38
23	. 45035	42	. 54965	. 46835	46	. 53165	. 01800	4	. 98200	37
24	. 45077	43	. 54923	. 46881	47	. 53119	. 01804	4	. 98196	36
25	9. 45120	43	10. 54880	9. 46928	47	10. 53072	10. 01808	3	9. 98192	35
26	. 45163	43	. 54837	. 46975	47	. 53025	. 01811	4	. 98189	34
27	. 45206	43	. 54794	. 47021	46	. 52979	. 01815	4	. 98185	33
28	. 45249	43	. 54751	. 47068	47	. 52932	. 01819	4	. 98181	32
29	. 45292	42	. 54708	. 47114	46	. 52886	. 01823	4	. 98177	31
30	9. 45334	43	10. 54666	9. 47160	47	10. 52840	10. 01826	4	9. 98174	30
31	. 45377	42	. 54623	. 47207	46	. 52793	. 01830	4	. 98170	29
32	. 45419	43	. 54581	. 47253	46	. 52747	. 01834	4	. 98166	28
33	. 45462	42	. 54538	. 47299	47	. 52701	. 01838	3	. 98162	27
34	. 45504	43	. 54496	. 47346	46	. 52654	. 01841	4	. 98159	26
35	9. 45547	42	10. 54453	9. 47392	46	10. 52608	10. 01845	4	9. 98155	25
36	. 45589	43	. 54411	. 47438	46	. 52562	. 01849	4	. 98151	24
37	. 45632	42	. 54368	. 47484	46	. 52516	. 01853	3	. 98147	23
38	. 45674	42	. 54326	. 47530	46	. 52470	. 01856	4	. 98144	22
39	. 45716	42	. 54284	. 47576	46	. 52424	. 01860	4	. 98140	21
40	9. 45758	43	10. 54242	9. 47622	46	10. 52378	10. 01864	4	9. 98136	20
41	. 45801	42	. 54199	. 47668	46	. 52332	. 01868	3	. 98132	19
42	. 45843	42	. 54157	. 47714	46	. 52286	. 01871	4	. 98129	18
43	. 45885	42	. 54115	. 47760	46	. 52240	. 01875	4	. 98125	17
44	. 45927	42	. 54073	. 47806	46	. 52194	. 01879	4	. 98121	16
45	9. 45969	42	10. 54031	9. 47852	45	10. 52148	10. 01883	4	9. 98117	15
46	. 46011	42	. 53989	. 47897	46	. 52103	. 01887	3	. 98113	14
47	. 46053	42	. 53947	. 47943	46	. 52057	. 01890	4	. 98110	13
48	. 46095	41	. 53905	. 47989	46	. 52011	. 01894	4	. 98106	12
49	. 46136	42	. 53864	. 48035	45	. 51965	. 01898	4	. 98102	11
50	9. 46178	42	10. 53822	9. 48080	46	10. 51920	10. 01902	4	9. 98098	10
51	. 46220	42	. 53780	. 48126	45	. 51874	. 01906	4	. 98094	9
52	. 46262	41	. 53738	. 48171	46	. 51829	. 01910	3	. 98090	8
53	. 46303	42	. 53697	. 48217	45	. 51783	. 01913	4	. 98087	7
54	. 46345	41	. 53655	. 48262	45	. 51738	. 01917	4	. 98083	6
55	9. 46386	42	10. 53614	9. 48307	46	10. 51693	10. 01921	4	9. 98079	5
56	. 46428	41	. 53572	. 48353	45	. 51647	. 01925	4	. 98075	4
57	. 46469	42	. 53531	. 48398	45	. 51602	. 01929	4	. 98071	3
58	. 46511	41	. 53489	. 48443	46	. 51557	. 01933	4	. 98067	2
59	. 46552	42	. 53448	. 48489	45	. 51511	. 01937	3	. 98063	1
60	9. 46594	42	10. 53406	9. 48534	45	10. 51466	10. 01940	3	9. 98060	0
106° ↑	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin	73° ↑

Logarithms of Trigonometric Functions

1

17°→		sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos	+162° ↓
0	9.46594	41	10.53406	9.48534	45	10.51466	10.01940	4	9.98060	60	
1	.46635	41	.53365	.48579	45	.51421	.01944	4	.98056	59	
2	.46676	41	.53324	.48624	45	.51376	.01948	4	.98052	58	
3	.46717	41	.53283	.48669	45	.51331	.01952	4	.98048	57	
4	.46758	42	.53242	.48714	45	.51286	.01956	4	.98044	56	
5	9.46800	41	10.53200	9.48759	45	10.51241	10.01960	4	9.98040	55	
6	.46841	41	.53159	.48804	45	.51196	.01964	4	.98036	54	
7	.46882	41	.53118	.48849	45	.51151	.01968	3	.98032	53	
8	.46923	41	.53077	.48894	45	.51106	.01971	4	.98029	52	
9	.46964	41	.53036	.48939	45	.51061	.01975	4	.98025	51	
10	9.47005	40	10.52995	9.48984	45	10.51016	10.01979	4	9.98021	50	
11	.47045	41	.52955	.49029	44	.50971	.01983	4	.98017	49	
12	.47086	41	.52914	.49073	45	.50927	.01987	4	.98013	48	
13	.47127	41	.52873	.49118	45	.50882	.01991	4	.98009	47	
14	.47168	41	.52832	.49163	44	.50837	.01995	4	.98005	46	
15	9.47209	40	10.52791	9.49207	45	10.50793	10.01999	4	9.98001	45	
16	.47249	41	.52751	.49252	44	.50748	.02003	4	.97997	44	
17	.47290	40	.52710	.49296	45	.50704	.02007	4	.97993	43	
18	.47330	41	.52670	.49341	44	.50659	.02011	3	.97989	42	
19	.47371	40	.52629	.49385	45	.50615	.02014	4	.97986	41	
20	9.47411	41	10.52589	9.49430	44	10.50570	10.02018	4	9.97982	40	
21	.47452	40	.52548	.49474	45	.50526	.02022	4	.97978	39	
22	.47492	41	.52508	.49519	44	.50481	.02026	4	.97974	38	
23	.47533	40	.52467	.49563	44	.50437	.02030	4	.97970	37	
24	.47573	40	.52427	.49607	45	.50393	.02034	4	.97966	36	
25	9.47613	41	10.52387	9.49652	44	10.50348	10.02038	4	9.97962	35	
26	.47654	40	.52346	.49696	44	.50304	.02042	4	.97958	34	
27	.47694	40	.52306	.49740	44	.50260	.02046	4	.97954	33	
28	.47734	40	.52266	.49784	44	.50216	.02050	4	.97950	32	
29	.47774	40	.52226	.49828	44	.50172	.02054	4	.97946	31	
30	9.47814	40	10.52186	9.49872	44	10.50128	10.02058	4	9.97942	30	
31	.47854	40	.52146	.49916	44	.50084	.02062	4	.97938	29	
32	.47894	40	.52106	.49960	44	.50040	.02066	4	.97934	28	
33	.47934	40	.52066	.50004	44	.49996	.02070	4	.97930	27	
34	.47974	40	.52026	.50048	44	.49952	.02074	4	.97926	26	
35	9.48014	40	10.51986	9.50092	44	10.49908	10.02078	4	9.97922	25	
36	.48054	40	.51946	.50136	44	.49864	.02082	4	.97918	24	
37	.48094	39	.51906	.50180	43	.49820	.02086	4	.97914	23	
38	.48133	40	.51867	.50223	44	.49777	.02090	4	.97910	22	
39	.48173	40	.51827	.50267	44	.49733	.02094	4	.97906	21	
40	9.48213	39	10.51787	9.50311	44	10.49689	10.02098	4	9.97902	20	
41	.48252	40	.51748	.50355	43	.49645	.02102	4	.97898	19	
42	.48292	40	.51708	.50398	44	.49602	.02106	4	.97894	18	
43	.48332	39	.51668	.50442	43	.49558	.02110	4	.97890	17	
44	.48371	40	.51629	.50485	44	.49515	.02114	4	.97886	16	
45	9.48411	39	10.51589	9.50529	43	10.49471	10.02118	4	9.97882	15	
46	.48450	40	.51550	.50572	44	.49428	.02122	4	.97878	14	
47	.48490	39	.51510	.50616	43	.49384	.02126	4	.97874	13	
48	.48529	39	.51471	.50659	44	.49341	.02130	4	.97870	12	
49	.48568	39	.51432	.50703	43	.49297	.02134	5	.97866	11	
50	9.48607	40	10.51393	9.50746	43	10.49254	10.02139	4	9.97861	10	
51	.48647	39	.51353	.50789	44	.49211	.02143	4	.97857	9	
52	.48686	39	.51314	.50833	43	.49167	.02147	4	.97853	8	
53	.48725	39	.51275	.50876	43	.49124	.02151	4	.97849	7	
54	.48764	39	.51236	.50919	43	.49081	.02155	4	.97845	6	
55	9.48803	39	10.51197	9.50962	43	10.49038	10.02159	4	9.97841	5	
56	.48842	39	.51158	.51005	43	.48995	.02163	4	.97837	4	
57	.48881	39	.51119	.51048	44	.48952	.02167	4	.97833	3	
58	.48920	39	.51080	.51092	44	.48908	.02171	4	.97829	2	
59	.48959	39	.51041	.51135	43	.48865	.02175	4	.97825	1	
60	9.48998	39	10.51002	9.51178	43	10.48822	10.02179	4	9.97821	0	
↑107°→		cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin	↑72°

1

Logarithms of Trigonometric Functions

18° ↑	sin	Diff. 1'	csc	tan	Diff. 1'	col	sec	Diff. 1'	cos	161° ↓
0	9.48998	39	10.51002	9.51178	43	10.48822	10.02179	4	9.97821	60
1	9.49037	39	50963	51221	43	48779	02183	5	9.97817	59
2	9.49076	39	50924	51264	42	48736	02188	4	9.97812	58
3	9.49115	38	50885	51306	42	48694	02192	4	9.97808	57
4	9.49153	38	50847	51349	43	48651	02196	4	9.97804	56
5	9.49192	39	10.50808	9.51392	43	10.48608	10.02200	4	9.97800	55
6	9.49231	38	50769	51435	43	48565	02204	4	9.97796	54
7	9.49269	38	50731	51478	42	48522	02208	4	9.97792	53
8	9.49308	39	50692	51520	42	48480	02212	4	9.97788	52
9	9.49347	38	50653	51563	43	48437	02216	5	9.97784	51
10	9.49385	39	10.50615	9.51606	42	10.48394	10.02221	4	9.97779	50
11	9.49424	38	50576	51648	43	48352	02225	4	9.97775	49
12	9.49462	38	50538	51691	43	48309	02229	4	9.97771	48
13	9.49500	39	50500	51734	42	48266	02233	4	9.97767	47
14	9.49539	38	50461	51776	43	48224	02237	4	9.97763	46
15	9.49577	38	10.50423	9.51819	42	10.48181	10.02241	5	9.97759	45
16	9.49615	39	50385	51861	42	48139	02246	4	9.97754	44
17	9.49654	38	50346	51903	43	48097	02250	4	9.97750	43
18	9.49692	38	50308	51946	42	48054	02254	4	9.97746	42
19	9.49730	38	50270	51988	43	48012	02258	4	9.97742	41
20	9.49768	38	10.50232	9.52031	42	10.47969	10.02262	4	9.97738	40
21	9.49806	38	50194	52073	42	47927	02266	5	9.97734	39
22	9.49844	38	50156	52115	42	47885	02271	4	9.97729	38
23	9.49882	38	50118	52157	43	47843	02275	4	9.97725	37
24	9.49920	38	50080	52200	42	47800	02279	4	9.97721	36
25	9.49958	38	10.50042	9.52242	42	10.47758	10.02283	4	9.97717	35
26	9.49996	38	50004	52284	42	47716	02287	5	9.97713	34
27	9.50034	38	49966	52326	42	47674	02292	4	9.97708	33
28	9.50072	38	49928	52368	42	47632	02296	4	9.97704	32
29	9.50110	38	49890	52410	42	47590	02300	4	9.97700	31
30	9.50148	37	10.49852	9.52452	42	10.47548	10.02304	5	9.97696	30
31	9.50185	38	49815	52494	42	47506	02309	4	9.97691	29
32	9.50223	38	49777	52536	42	47464	02313	4	9.97687	28
33	9.50261	37	49739	52578	42	47422	02317	4	9.97683	27
34	9.50298	38	49702	52620	41	47380	02321	5	9.97679	26
35	9.50336	38	10.49664	9.52661	42	10.47339	10.02326	4	9.97674	25
36	9.50374	37	49626	52703	42	47297	02330	4	9.97670	24
37	9.50411	38	49589	52745	42	47255	02334	4	9.97666	23
38	9.50449	37	49551	52787	42	47213	02338	5	9.97662	22
39	9.50486	37	49514	52829	41	47171	02343	4	9.97657	21
40	9.50523	38	10.49477	9.52870	42	10.47130	10.02347	4	9.97653	20
41	9.50561	37	49439	52912	41	47088	02351	4	9.97649	19
42	9.50598	37	49402	52953	42	47047	02355	5	9.97645	18
43	9.50635	37	49365	52995	42	47005	02360	4	9.97640	17
44	9.50673	37	49327	53037	41	46963	02364	4	9.97636	16
45	9.50710	37	10.49290	9.53078	42	10.46922	10.02368	4	9.97632	15
46	9.50747	37	49253	53120	41	46880	02372	5	9.97628	14
47	9.50784	37	49216	53161	41	46839	02377	4	9.97623	13
48	9.50821	37	49179	53202	42	46798	02381	4	9.97619	12
49	9.50858	38	49142	53244	41	46756	02385	5	9.97615	11
50	9.50896	37	10.49104	9.53285	42	10.46715	10.02390	4	9.97610	10
51	9.50933	37	49067	53327	41	46673	02394	4	9.97606	9
52	9.50970	37	49030	53368	41	46632	02398	5	9.97602	8
53	9.51007	36	48993	53409	41	46591	02403	4	9.97597	7
54	9.51043	37	48957	53450	42	46550	02407	4	9.97593	6
55	9.51080	37	10.48920	9.53492	41	10.46508	10.02411	5	9.97589	5
56	9.51117	37	48883	53533	41	46467	02416	4	9.97584	4
57	9.51154	37	48846	53574	41	46426	02420	4	9.97580	3
58	9.51191	36	48809	53615	41	46385	02424	5	9.97576	2
59	9.51227	37	48773	53656	41	46344	02429	4	9.97571	1
60	9.51264	37	10.48736	9.53697	41	10.46303	10.02433	4	9.97567	0
108° ↑	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin	71° ↓

Logarithms of Trigonometric Functions

1

19° ↓	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos ←160° ↓
0	9. 51264	37	10. 48736	9. 53697	41	10. 46303	10. 02433	4	9. 97567
1	51301	37	48699	53738	41	46262	02437	5	97563
2	51338	36	48662	53779	41	46221	02442	4	97558
3	51374	37	48626	53820	41	46180	02446	4	97554
4	51411	36	48589	53861	41	46139	02450	5	97550
5	9. 51447	37	10. 48553	9. 53902	41	10. 46098	10. 02455	4	9. 97545
6	51484	36	48516	53943	41	46057	02459	5	97541
7	51520	37	48480	53984	41	46016	02464	4	97536
8	51557	36	48443	54025	40	45975	02468	4	97532
9	51593	36	48407	54065	41	45935	02472	5	97528
10	9. 51629	37	10. 48371	9. 54106	41	10. 45894	10. 02477	4	9. 97523
11	51666	36	48334	54147	40	45853	02481	4	97519
12	51702	36	48298	54187	41	45813	02485	5	97515
13	51738	36	48262	54228	41	45772	02490	4	97510
14	51774	37	48226	54269	40	45731	02494	5	97506
15	9. 51811	36	10. 48189	9. 54309	41	10. 45691	10. 02499	4	9. 97501
16	51847	36	48153	54350	40	45650	02503	5	97497
17	51883	36	48117	54390	41	45610	02508	4	97492
18	51919	36	48081	54431	40	45569	02512	4	97488
19	51955	36	48045	54471	41	45529	02516	5	97484
20	9. 51991	36	10. 48009	9. 54512	40	10. 45488	10. 02521	4	9. 97479
21	52027	36	47973	54552	41	45448	02525	5	97475
22	52063	36	47937	54593	40	45407	02530	4	97470
23	52099	36	47901	54633	40	45367	02534	5	97466
24	52135	36	47865	54673	41	45327	02539	4	97461
25	9. 52171	36	10. 47829	9. 54714	40	10. 45286	10. 02543	4	9. 97457
26	52207	35	47793	54754	40	45246	02547	5	97453
27	52242	36	47758	54794	41	45206	02552	4	97448
28	52278	36	47722	54835	40	45165	02556	5	97444
29	52314	36	47686	54875	40	45125	02561	4	97439
30	9. 52350	35	10. 47650	9. 54915	40	10. 45085	10. 02565	5	9. 97435
31	52385	36	47615	54955	40	45045	02570	4	97430
32	52421	35	47579	54995	40	45005	02574	5	97426
33	52456	36	47544	55035	40	44965	02579	4	97421
34	52492	35	47508	55075	40	44925	02583	5	97417
35	9. 52527	36	10. 47473	9. 55115	40	10. 44885	10. 02588	4	9. 97412
36	52563	35	47437	55155	40	44845	02592	5	97408
37	52598	36	47402	55195	40	44805	02597	4	97403
38	52634	35	47366	55235	40	44765	02601	5	97399
39	52669	36	47331	55275	40	44725	02606	4	97394
40	9. 52705	35	10. 47295	9. 55315	40	10. 44685	10. 02610	5	9. 97390
41	52740	35	47260	55355	40	44645	02615	4	97385
42	52775	36	47225	55395	39	44605	02619	5	97381
43	52811	35	47189	55434	40	44566	02624	4	97376
44	52846	35	47154	55474	40	44526	02628	5	97372
45	9. 52881	35	10. 47119	9. 55514	40	10. 44486	10. 02633	4	9. 97367
46	52916	35	47084	55554	39	44446	02637	5	97363
47	52951	35	47049	55593	40	44407	02642	5	97358
48	52986	35	47014	55633	40	44367	02647	4	97353
49	53021	35	46979	55673	39	44327	02651	5	97349
50	9. 53056	36	10. 46944	9. 55712	40	10. 44288	10. 02656	4	9. 97344
51	53092	34	46908	55752	39	44248	02660	5	97340
52	53126	35	46874	55791	40	44209	02665	4	97335
53	53161	35	46839	55831	39	44169	02669	5	97331
54	53196	35	46804	55870	40	44130	02674	4	97326
55	9. 53231	35	10. 46769	9. 55910	39	10. 44090	10. 02678	5	9. 97322
56	53266	35	46734	55949	40	44051	02683	5	97317
57	53301	35	46699	55989	39	44011	02688	4	97312
58	53336	34	46664	56028	39	43972	02692	5	97308
59	53370	35	46630	56067	40	43933	02697	4	97303
60	9. 53405	35	10. 46595	9. 56107	40	10. 43893	10. 02701	4	9. 97299
↑109°	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin ←70° ↑

1

Logarithms of Trigonometric Functions

20° ↓	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos +159° ↓	
0	9. 53405	35	10. 46595	9. 56107	39	10. 43893	10. 02701	5	9. 97299	60
1	. 53440	35	. 46560	. 56146	39	. 43854	. 02706	5	. 97294	59
2	. 53475	34	. 46525	. 56185	39	. 43815	. 02711	4	. 97289	58
3	. 53509	35	. 46491	. 56224	40	. 43776	. 02715	5	. 97285	57
4	. 53544	34	. 46456	. 56264	39	. 43736	. 02720	4	. 97280	56
5	9. 53578	35	10. 46422	9. 56303	39	10. 43697	10. 02724	5	9. 97276	55
6	. 53613	34	. 46387	. 56342	39	. 43658	. 02729	5	. 97271	54
7	. 53647	35	. 46353	. 56381	39	. 43619	. 02734	4	. 97266	53
8	. 53682	34	. 46318	. 56420	39	. 43580	. 02738	5	. 97262	52
9	. 53716	35	. 46284	. 56459	39	. 43541	. 02743	5	. 97257	51
10	9. 53751	34	10. 46249	9. 56498	39	10. 43502	10. 02748	4	9. 97252	50
11	. 53785	34	. 46215	. 56537	39	. 43463	. 02753	5	. 97248	49
12	. 53819	35	. 46181	. 56576	39	. 43424	. 02757	5	. 97243	48
13	. 53854	34	. 46146	. 56615	39	. 43385	. 02762	4	. 97238	47
14	. 53888	34	. 46112	. 56654	39	. 43346	. 02766	5	. 97234	46
15	9. 53922	35	10. 46078	9. 56693	39	10. 43307	10. 02771	5	9. 97229	45
16	. 53957	34	. 46043	. 56732	39	. 43268	. 02776	4	. 97224	44
17	. 53991	34	. 46009	. 56771	39	. 43229	. 02780	5	. 97220	43
18	. 54025	34	. 45975	. 56810	39	. 43190	. 02785	5	. 97215	42
19	. 54059	34	. 45941	. 56849	38	. 43151	. 02790	4	. 97210	41
20	9. 54093	34	10. 45907	9. 56887	39	10. 43113	10. 02794	5	9. 97206	40
21	. 54127	34	. 45873	. 56926	39	. 43074	. 02799	5	. 97201	39
22	. 54161	34	. 45839	. 56965	39	. 43035	. 02804	4	. 97196	38
23	. 54195	34	. 45805	. 57004	38	. 42996	. 02808	5	. 97192	37
24	. 54229	34	. 45771	. 57042	39	. 42958	. 02813	5	. 97187	36
25	9. 54263	34	10. 45737	9. 57081	39	10. 42919	10. 02818	4	9. 97182	35
26	. 54297	34	. 45703	. 57120	38	. 42880	. 02822	5	. 97178	34
27	. 54331	34	. 45669	. 57158	39	. 42842	. 02827	5	. 97173	33
28	. 54365	34	. 45635	. 57197	38	. 42803	. 02832	5	. 97168	32
29	. 54399	34	. 45601	. 57235	39	. 42765	. 02837	4	. 97163	31
30	9. 54433	33	10. 45567	9. 57274	38	10. 42726	10. 02841	5	9. 97159	30
31	. 54466	34	. 45534	. 57312	39	. 42688	. 02846	5	. 97154	29
32	. 54500	34	. 45500	. 57351	38	. 42649	. 02851	4	. 97149	28
33	. 54534	33	. 45466	. 57389	39	. 42611	. 02855	5	. 97145	27
34	. 54567	34	. 45433	. 57428	38	. 42572	. 02860	5	. 97140	26
35	9. 54601	34	10. 45399	9. 57466	38	10. 42534	10. 02865	5	9. 97135	25
36	. 54635	33	. 45365	. 57504	39	. 42496	. 02870	4	. 97130	24
37	. 54668	34	. 45332	. 57543	38	. 42457	. 02874	5	. 97126	23
38	. 54702	34	. 45298	. 57581	38	. 42419	. 02879	5	. 97121	22
39	. 54735	34	. 45265	. 57619	39	. 42381	. 02884	5	. 97116	21
40	9. 54769	33	10. 45231	9. 57658	38	10. 42342	10. 02889	4	9. 97111	20
41	. 54802	34	. 45198	. 57696	38	. 42304	. 02893	5	. 97107	19
42	. 54836	33	. 45164	. 57734	38	. 42266	. 02898	5	. 97102	18
43	. 54869	34	. 45131	. 57772	38	. 42228	. 02903	5	. 97097	17
44	. 54903	33	. 45097	. 57810	39	. 42190	. 02908	5	. 97092	16
45	9. 54936	33	10. 45064	9. 57849	38	10. 42151	10. 02913	4	9. 97087	15
46	. 54969	34	. 45031	. 57887	38	. 42113	. 02917	5	. 97083	14
47	. 55003	33	. 44997	. 57925	38	. 42075	. 02922	5	. 97078	13
48	. 55036	33	. 44964	. 57963	38	. 42037	. 02927	5	. 97073	12
49	. 55069	33	. 44931	. 58001	38	. 41999	. 02932	5	. 97068	11
50	9. 55102	34	10. 44898	9. 58039	38	10. 41961	10. 02937	4	9. 97063	10
51	. 55136	33	. 44864	. 58077	38	. 41923	. 02941	5	. 97059	9
52	. 55169	33	. 44831	. 58115	38	. 41885	. 02946	5	. 97054	8
53	. 55202	33	. 44798	. 58153	38	. 41847	. 02951	5	. 97049	7
54	. 55235	33	. 44765	. 58191	38	. 41809	. 02956	5	. 97044	6
55	9. 55268	33	10. 44732	9. 58229	38	10. 41771	10. 02961	4	9. 97039	5
56	. 55301	33	. 44699	. 58267	37	. 41733	. 02965	5	. 97035	4
57	. 55334	33	. 44666	. 58304	38	. 41696	. 02970	5	. 97030	3
58	. 55367	33	. 44633	. 58342	38	. 41658	. 02975	5	. 97025	2
59	. 55400	33	. 44600	. 58380	38	. 41620	. 02980	5	. 97020	1
60	9. 55433	33	10. 44567	9. 58418	38	10. 41582	10. 02985		9. 97015	0
↑ 110°	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin +69° ↑	

Logarithms of Trigonometric Functions

1

21°	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos	158°
0	9. 55433	33	10. 44567	9. 58418	37	10. 41582	10. 02985	5	9. 97015	60
1	55466	33	44534	58455	38	41545	02990	5	97010	59
2	55499	33	44501	58493	38	41507	02995	4	97005	58
3	55532	32	44468	58531	38	41469	02999	4	97001	57
4	55564	33	44436	58569	37	41431	03004	5	96996	56
5	9. 55597	33	10. 44403	9. 58606	38	10. 41394	10. 03009	5	9. 96991	55
6	55630	33	44370	58644	37	41356	03014	5	96986	54
7	55663	32	44337	58681	38	41319	03019	5	96981	53
8	55695	33	44305	58719	38	41281	03024	5	96976	52
9	55728	33	44272	58757	37	41243	03029	5	96971	51
10	9. 55761	32	10. 44239	9. 58794	38	10. 41206	10. 03034	4	9. 96966	50
11	55793	33	44207	58832	37	41168	03038	5	96962	49
12	55826	32	44174	58869	38	41131	03043	5	96957	48
13	55858	33	44142	58907	37	41093	03048	5	96952	47
14	55891	32	44109	58944	37	41056	03053	5	96947	46
15	9. 55923	33	10. 44077	9. 58981	38	10. 41019	10. 03058	5	9. 96942	45
16	55956	32	44044	59019	37	40981	03063	5	96937	44
17	55988	33	44012	59056	38	40944	03068	5	96932	43
18	56021	32	43979	59094	37	40906	03073	5	96927	42
19	56053	32	43947	59131	37	40869	03078	5	96922	41
20	9. 56085	33	10. 43915	9. 59168	37	10. 40832	10. 03083	5	9. 96917	40
21	56118	32	43882	59205	38	40795	03088	5	96912	39
22	56150	32	43850	59243	37	40757	03093	4	96907	38
23	56182	33	43818	59280	37	40720	03097	5	96903	37
24	56215	32	43785	59317	37	40683	03102	5	96898	36
25	9. 56247	32	10. 43753	9. 59354	37	10. 40646	10. 03107	5	9. 96893	35
26	56279	32	43721	59391	38	40609	03112	5	96888	34
27	56311	32	43689	59429	37	40571	03117	5	96883	33
28	56343	32	43657	59466	37	40534	03122	5	96878	32
29	56375	33	43625	59503	37	40497	03127	5	96873	31
30	9. 56408	32	10. 43592	9. 59540	37	10. 40460	10. 03132	5	9. 96868	30
31	56440	32	43560	59577	37	40423	03137	5	96863	29
32	56472	32	43528	59614	37	40386	03142	5	96858	28
33	56504	32	43496	59651	37	40349	03147	5	96853	27
34	56536	32	43464	59688	37	40312	03152	5	96848	26
35	9. 56568	31	10. 43432	9. 59725	37	10. 40275	10. 03157	5	9. 96843	25
36	56599	32	43401	59762	37	40238	03162	5	96838	24
37	56631	32	43369	59799	36	40201	03167	5	96833	23
38	56663	32	43337	59835	37	40165	03172	5	96828	22
39	56695	32	43305	59872	37	40128	03177	5	96823	21
40	9. 56727	32	10. 43273	9. 59909	37	10. 40091	10. 03182	5	9. 96818	20
41	56759	31	43241	59946	37	40054	03187	5	96813	19
42	56790	32	43210	59983	36	40017	03192	5	96808	18
43	56822	32	43178	60019	37	39981	03197	5	96803	17
44	56854	32	43146	60056	37	39944	03202	5	96798	16
45	9. 56886	31	10. 43114	9. 60093	37	10. 39907	10. 03207	5	9. 96793	15
46	56917	32	43083	60130	36	39870	03212	5	96788	14
47	56949	31	43051	60166	37	39834	03217	5	96783	13
48	56980	32	43020	60203	37	39797	03222	6	96778	12
49	57012	32	42988	60240	36	39760	03228	5	96772	11
50	9. 57044	31	10. 42956	9. 60276	37	10. 39724	10. 03233	5	9. 96767	10
51	57075	32	42925	60313	36	39687	03238	5	96762	9
52	57107	31	42893	60349	37	39651	03243	5	96757	8
53	57138	31	42862	60386	36	39614	03248	5	96752	7
54	57169	32	42831	60422	37	39578	03253	5	96747	6
55	9. 57201	31	10. 42799	9. 60459	36	10. 39541	10. 03258	5	9. 96742	5
56	57232	32	42768	60495	37	39505	03263	5	96737	4
57	57264	31	42736	60532	36	39468	03268	5	96732	3
58	57295	31	42705	60568	37	39432	03273	5	96727	2
59	57326	32	42674	60605	36	39395	03278	5	96722	1
60	9. 57358	32	11. 42642	9. 60641	36	10. 39359	10. 03283	5	9. 96717	0
↑ 111°	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin	↓ 68°

<div> <div>1</div> <div>Logarithms of Trigonometric Functions</div> </div>									
22°→ ↓	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos ←157° ↓
0	9. 57358	31	10. 42642	9. 60641	36	10. 39359	10. 03283	6	9. 96717
1	57389	31	42611	60677	37	39323	03289	5	96711
2	57420	31	42580	60714	36	39286	03294	5	96706
3	57451	31	42549	60750	36	39250	03299	5	96701
4	57482	31	42518	60786	36	39214	03304	5	96696
		32			37			5	
5	9. 57514	31	10. 42486	9. 60823	36	10. 39177	10. 03309	5	9. 96691
6	57545	31	42455	60859	36	39141	03314	5	96686
7	57576	31	42424	60895	36	39105	03319	5	96681
8	57607	31	42393	60931	36	39069	03324	5	96676
9	57638	31	42362	60967	36	39033	03330	6	96670
		31			37			5	
10	9. 57669	31	10. 42331	9. 61004	36	10. 38996	10. 03335	5	9. 96665
11	57700	31	42300	61040	36	38960	03340	5	96660
12	57731	31	42269	61076	36	38924	03345	5	96655
13	57762	31	42238	61112	36	38888	03350	5	96650
14	57793	31	42207	61148	36	38852	03355	5	96645
		31			36			5	
15	9. 57824	31	10. 42176	9. 61184	36	10. 38816	10. 03360	6	9. 96640
16	57855	30	42145	61220	36	38780	03366	5	96634
17	57885	31	42115	61256	36	38744	03371	5	96629
18	57916	31	42084	61292	36	38708	03376	5	96624
19	57947	31	42053	61328	36	38672	03381	5	96619
		31			36			5	
20	9. 57978	30	10. 42022	9. 61364	36	10. 38636	10. 03386	6	9. 96614
21	58008	31	41992	61400	36	38600	03392	5	96608
22	58039	31	41961	61436	36	38564	03397	5	96603
23	58070	31	41930	61472	36	38528	03402	5	96598
24	58101	31	41899	61508	36	38492	03407	5	96593
		30			36			5	
25	9. 58131	31	10. 41869	9. 61544	35	10. 38456	10. 03412	6	9. 96588
26	58162	30	41838	61579	36	38421	03418	5	96582
27	58192	31	41808	61615	36	38385	03423	5	96577
28	58223	30	41777	61651	36	38349	03428	5	96572
29	58253	31	41747	61687	35	38313	03433	5	96567
		31			36			5	
30	9. 58284	30	10. 41716	9. 61722	36	10. 38278	10. 03438	6	9. 96562
31	58314	31	41686	61758	36	38242	03444	5	96556
32	58345	30	41655	61794	36	38206	03449	5	96551
33	58375	31	41625	61830	35	38170	03454	5	96546
34	58406	30	41594	61865	36	38135	03459	6	96541
		30			35			5	
35	9. 58436	31	10. 41564	9. 61901	35	10. 38099	10. 03465	5	9. 96535
36	58467	30	41533	61936	36	38064	03470	5	96530
37	58497	30	41503	61972	36	38028	03475	5	96525
38	58527	30	41473	62008	35	37992	03480	6	96520
39	58557	31	41443	62043	36	37957	03486	5	96514
		30			35			5	
40	9. 58588	30	10. 41412	9. 62079	35	10. 37921	10. 03491	5	9. 96509
41	58618	30	41382	62114	36	37886	03496	6	96504
42	58648	30	41352	62150	35	37850	03502	5	96498
43	58678	30	41322	62185	35	37815	03507	5	96493
44	58709	31	41291	62221	36	37779	03512	5	96488
		30			35			5	
45	9. 58739	30	10. 41261	9. 62256	36	10. 37744	10. 03517	6	9. 96483
46	58769	30	41231	62292	35	37708	03523	5	96477
47	58799	30	41201	62327	35	37673	03528	5	96472
48	58829	30	41171	62362	35	37638	03533	6	96467
49	58859	30	41141	62398	36	37602	03539	5	96461
		30			35			5	
50	9. 58889	30	10. 41111	9. 62433	35	10. 37567	10. 03544	5	9. 96456
51	58919	30	41081	62468	36	37532	03549	6	96451
52	58949	30	41051	62504	35	37496	03555	5	96445
53	58979	30	41021	62539	35	37461	03560	5	96440
54	59009	30	40991	62574	35	37426	03565	6	96435
		30			35			5	
55	9. 59039	30	10. 40961	9. 62609	36	10. 37391	10. 03571	5	9. 96429
56	59069	29	40931	62645	35	37355	03576	5	96424
57	59098	30	40902	62680	35	37320	03581	6	96419
58	59128	30	40872	62715	35	37285	03587	5	96413
59	59158	30	40842	62750	35	37250	03592	5	96408
60	9. 59188	30	10. 40812	9. 62785	35	10. 37215	10. 03597	5	9. 96403
↑112°→	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin ←67° ↑

Logarithms of Trigonometric Functions

1

23°→		Diff.			Diff.			Diff.	cos ←156°	
↓		1'	csc	tan	1'	cot	sec	1'	↓	
0	9. 59188	30	10. 40812	9. 62785	35	10. 37215	10. 03597	6	9. 96403	60
1	59218	29	40782	62820	35	37180	03603	5	96397	59
2	59247	30	40753	62855	35	37145	03608	5	96392	58
3	59277	30	40723	62890	36	37110	03613	6	96387	57
4	59307	29	40693	62926	35	37074	03619	5	96381	56
5	9. 59336	30	10. 40664	9. 62961	35	10. 37039	10. 03624	6	9. 96376	55
6	59366	30	40634	62996	35	37004	03630	5	96370	54
7	59396	30	40604	63031	35	36969	03635	5	96365	53
8	59425	30	40575	63066	35	36934	03640	6	96360	52
9	59455	29	40545	63101	34	36899	03646	5	96354	51
10	9. 59484	30	10. 40516	9. 63135	35	10. 36865	10. 03651	6	9. 96349	50
11	59514	29	40486	63170	35	36830	03657	5	96343	49
12	59543	30	40457	63205	35	36795	03662	5	96338	48
13	59573	29	40427	63240	35	36760	03667	6	96333	47
14	59602	30	40398	63275	35	36725	03673	5	96327	46
15	9. 59632	29	10. 40368	9. 63310	35	10. 36690	10. 03678	6	9. 96322	45
16	59661	29	40339	63345	34	36655	03684	5	96316	44
17	59690	29	40310	63379	35	36621	03689	6	96311	43
18	59720	30	40280	63414	35	36586	03695	5	96305	42
19	59749	29	40251	63449	35	36551	03700	6	96300	41
20	9. 59778	30	10. 40222	9. 63484	35	10. 36516	10. 03706	5	9. 96294	40
21	59808	29	40192	63519	34	36481	03711	5	96289	39
22	59837	29	40163	63553	35	36447	03716	6	96284	38
23	59866	29	40134	63588	35	36412	03722	5	96278	37
24	59895	29	40105	63623	34	36377	03727	6	96273	36
25	9. 59924	30	10. 40076	9. 63657	35	10. 36343	10. 03733	5	9. 96267	35
26	59954	29	40046	63692	34	36308	03738	5	96262	34
27	59983	29	40017	63726	35	36274	03744	5	96256	33
28	60012	29	39988	63761	35	36239	03749	6	96251	32
29	60041	29	39959	63796	34	36204	03755	5	96245	31
30	9. 60070	29	10. 39930	9. 63830	35	10. 36170	10. 03760	6	9. 96240	30
31	60099	29	39901	63865	34	36135	03766	5	96234	29
32	60128	29	39872	63899	35	36101	03771	6	96229	28
33	60157	29	39843	63934	34	36066	03777	5	96223	27
34	60186	29	39814	63968	35	36032	03782	6	96218	26
35	9. 60215	29	10. 39785	9. 64003	34	10. 35997	10. 03788	5	9. 96212	25
36	60244	29	39756	64037	35	35963	03793	6	96207	24
37	60273	29	39727	64072	34	35928	03799	5	96201	23
38	60302	29	39698	64106	34	35894	03804	6	96196	22
39	60331	28	39669	64140	35	35860	03810	5	96190	21
40	9. 60359	29	10. 39641	9. 64175	34	10. 35825	10. 03815	6	9. 96185	20
41	60388	29	39612	64209	34	35791	03821	5	96179	19
42	60417	29	39583	64243	35	35757	03826	6	96174	18
43	60446	28	39554	64278	34	35722	03832	6	96168	17
44	60474	29	39526	64312	34	35688	03838	5	96162	16
45	9. 60503	29	10. 39497	9. 64346	35	10. 35654	10. 03843	6	9. 96157	15
46	60532	29	39468	64381	34	35619	03849	5	96151	14
47	60561	28	39439	64415	34	35585	03854	6	96146	13
48	60589	29	39411	64449	34	35551	03860	5	96140	12
49	60618	28	39382	64483	34	35517	03865	6	96135	11
50	9. 60646	29	10. 39354	9. 64517	35	10. 35483	10. 03871	6	9. 96129	10
51	60675	29	39325	64552	34	35448	03877	5	96123	9
52	60704	28	39296	64586	34	35414	03882	6	96118	8
53	60732	29	39268	64620	34	35380	03888	5	96112	7
54	60761	28	39239	64654	34	35346	03893	6	96107	6
55	9. 60789	29	10. 39211	9. 64688	34	10. 35312	10. 03899	6	9. 96101	5
56	60818	28	39182	64722	34	35278	03905	5	96095	4
57	60846	29	39154	64756	34	35244	03910	6	96090	3
58	60875	28	39125	64790	34	35210	03916	5	96084	2
59	60903	28	39097	64824	34	35176	03921	6	96079	1
60	9. 60931	28	10. 39069	9. 64858	34	10. 35142	10. 03927		9. 96073	0
↑113°→		Diff.			Diff.			Diff.	sin ←66°	
		1'	sec	cot	1'	tan	csc	1'		

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Logarithms of Trigonometric Functions

24° ↓	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos +155° ↓
0	9. 60931	29	10. 39069	9. 64858	34	10. 35142	10. 03927	6	9. 96073
1	. 60960	28	. 39040	. 64892	34	. 35108	. 03933	5	. 96067
2	. 60988	28	. 39012	. 64926	34	. 35074	. 03938	6	. 96062
3	. 61016	29	. 38984	. 64960	34	. 35040	. 03944	6	. 96056
4	. 61045	28	. 38955	. 64994	34	. 35006	. 03950	5	. 96050
5	9. 61073	28	10. 38927	9. 65028	34	10. 34972	10. 03955	6	9. 96045
6	. 61101	28	. 38899	. 65062	34	. 34938	. 03961	5	. 96039
7	. 61129	29	. 38871	. 65096	34	. 34904	. 03966	6	. 96034
8	. 61158	28	. 38842	. 65130	34	. 34870	. 03972	6	. 96028
9	. 61186	28	. 38814	. 65164	33	. 34836	. 03978	5	. 96022
10	9. 61214	28	10. 38786	9. 65197	34	10. 34803	10. 03983	6	9. 96017
11	. 61242	28	. 38758	. 65231	34	. 34769	. 03989	6	. 96011
12	. 61270	28	. 38730	. 65265	34	. 34735	. 03995	5	. 96005
13	. 61298	28	. 38702	. 65299	34	. 34701	. 04000	6	. 96000
14	. 61326	28	. 38674	. 65333	33	. 34667	. 04006	6	. 95994
15	9. 61354	28	10. 38646	9. 65366	34	10. 34634	10. 04012	6	9. 95988
16	. 61382	29	. 38618	. 65400	34	. 34600	. 04018	5	. 95982
17	. 61411	27	. 38589	. 65434	33	. 34566	. 04023	6	. 95977
18	. 61438	28	. 38562	. 65467	34	. 34533	. 04029	6	. 95971
19	. 61466	28	. 38534	. 65501	34	. 34499	. 04035	5	. 95965
20	9. 61494	28	10. 38506	9. 65535	33	10. 34465	10. 04040	6	9. 95960
21	. 61522	28	. 38478	. 65568	34	. 34432	. 04046	6	. 95954
22	. 61550	28	. 38450	. 65602	34	. 34398	. 04052	6	. 95948
23	. 61578	28	. 38422	. 65636	34	. 34364	. 04058	5	. 95942
24	. 61606	28	. 38394	. 65669	33	. 34331	. 04063	6	. 95937
25	9. 61634	28	10. 38366	9. 65703	33	10. 34297	10. 04069	6	9. 95931
26	. 61662	27	. 38338	. 65736	34	. 34264	. 04075	5	. 95925
27	. 61689	28	. 38311	. 65770	33	. 34230	. 04080	6	. 95920
28	. 61717	28	. 38283	. 65803	34	. 34197	. 04086	6	. 95914
29	. 61745	28	. 38255	. 65837	33	. 34163	. 04092	6	. 95908
30	9. 61773	27	10. 38227	9. 65870	34	10. 34130	10. 04098	5	9. 95902
31	. 61800	28	. 38200	. 65904	33	. 34096	. 04103	6	. 95897
32	. 61828	28	. 38172	. 65937	34	. 34063	. 04109	6	. 95891
33	. 61856	28	. 38144	. 65971	33	. 34029	. 04115	6	. 95885
34	. 61883	28	. 38117	. 66004	34	. 33996	. 04121	6	. 95879
35	9. 61911	28	10. 38089	9. 66038	33	10. 33962	10. 04127	5	9. 95873
36	. 61939	27	. 38061	. 66071	33	. 33929	. 04132	6	. 95868
37	. 61966	28	. 38034	. 66104	34	. 33896	. 04138	6	. 95862
38	. 61994	28	. 38006	. 66138	33	. 33862	. 04144	6	. 95856
39	. 62021	27	. 37979	. 66171	33	. 33829	. 04150	6	. 95850
40	9. 62049	28	10. 37951	9. 66204	34	10. 33796	10. 04156	5	9. 95844
41	. 62076	28	. 37924	. 66238	33	. 33762	. 04161	6	. 95839
42	. 62104	27	. 37896	. 66271	33	. 33729	. 04167	6	. 95833
43	. 62131	28	. 37869	. 66304	33	. 33696	. 04173	6	. 95827
44	. 62159	27	. 37841	. 66337	34	. 33663	. 04179	6	. 95821
45	9. 62186	28	10. 37814	9. 66371	33	10. 33629	10. 04185	5	9. 95815
46	. 62214	27	. 37786	. 66404	33	. 33596	. 04190	6	. 95810
47	. 62241	27	. 37759	. 66437	33	. 33563	. 04196	6	. 95804
48	. 62268	27	. 37732	. 66470	33	. 33530	. 04202	6	. 95798
49	. 62296	27	. 37704	. 66503	34	. 33497	. 04208	6	. 95792
50	9. 62323	27	10. 37677	9. 66537	33	10. 33463	10. 04214	6	9. 95786
51	. 62350	27	. 37650	. 66570	33	. 33430	. 04220	5	. 95780
52	. 62377	28	. 37623	. 66603	33	. 33397	. 04225	6	. 95775
53	. 62405	27	. 37595	. 66636	33	. 33364	. 04231	6	. 95769
54	. 62432	27	. 37568	. 66669	33	. 33331	. 04237	6	. 95763
55	9. 62459	27	10. 37541	9. 66702	33	10. 33298	10. 04243	6	9. 95757
56	. 62486	27	. 37514	. 66735	33	. 33265	. 04249	6	. 95751
57	. 62513	28	. 37487	. 66768	33	. 33232	. 04255	6	. 95745
58	. 62541	27	. 37459	. 66801	33	. 33199	. 04261	6	. 95739
59	. 62568	27	. 37432	. 66834	33	. 33166	. 04267	5	. 95733
60	9. 62595	27	10. 37405	9. 66867	33	10. 33133	10. 04272	5	9. 95728
↑ 14°	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin +65° ↑

Logarithms of Trigonometric Functions

1

25° ↑	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos ←154° ↑
0	9.62595	27	10.37405	9.66867	33	10.33133	10.04272	6	9.95728
1	9.62622	27	37378	66900	33	33100	04278	6	95722
2	9.62649	27	37351	66933	33	33067	04284	6	95716
3	9.62676	27	37324	66966	33	33034	04290	6	95710
4	9.62703	27	37297	66999	33	33001	04296	6	95704
5	9.62730	27	37270	67032	33	32968	10.04302	6	9.95698
6	9.62757	27	37243	67065	33	32935	04308	6	95692
7	9.62784	27	37216	67098	33	32902	04314	6	95686
8	9.62811	27	37189	67131	33	32869	04320	6	95680
9	9.62838	27	37162	67163	33	32837	04326	6	95674
10	9.62865	27	37135	9.67196	33	10.32804	10.04332	5	9.95668
11	9.62892	26	37108	67229	33	32771	04337	6	95663
12	9.62918	27	37082	67262	33	32738	04343	6	95657
13	9.62945	27	37055	67295	32	32705	04349	6	95651
14	9.62972	27	37028	67327	33	32673	04355	6	95645
15	9.62999	27	10.37001	9.67360	33	10.32640	10.04361	6	9.95639
16	9.63026	26	36974	67393	33	32607	04367	6	95633
17	9.63052	27	36948	67426	32	32574	04373	6	95627
18	9.63079	27	36921	67458	33	32542	04379	6	95621
19	9.63106	27	36894	67491	33	32509	04385	6	95615
20	9.63133	27	10.36867	9.67524	33	10.32476	10.04391	6	9.95609
21	9.63159	27	36841	67556	33	32444	04397	6	95603
22	9.63186	27	36814	67589	33	32411	04403	6	95597
23	9.63213	26	36787	67622	32	32378	04409	6	95591
24	9.63239	27	36761	67654	33	32346	04415	6	95585
25	9.63266	26	10.36734	9.67687	32	10.32313	10.04421	6	9.95579
26	9.63292	27	36708	67719	33	32281	04427	6	95573
27	9.63319	26	36681	67752	33	32248	04433	6	95567
28	9.63345	27	36655	67785	32	32215	04439	6	95561
29	9.63372	26	36628	67817	33	32183	04445	6	95555
30	9.63398	26	10.36602	9.67850	32	10.32150	10.04451	6	9.95549
31	9.63425	26	36575	67882	33	32118	04457	6	95543
32	9.63451	27	36549	67915	32	32085	04463	6	95537
33	9.63478	26	36522	67947	33	32053	04469	6	95531
34	9.63504	27	36496	67980	32	32020	04475	6	95525
35	9.63531	26	10.36469	9.68012	32	10.31988	10.04481	6	9.95519
36	9.63557	26	36443	68044	33	31956	04487	6	95513
37	9.63583	27	36417	68077	32	31923	04493	7	95507
38	9.63610	26	36390	68109	33	31891	04500	6	95500
39	9.63636	26	36364	68142	32	31858	04506	6	95494
40	9.63662	27	10.36338	9.68174	32	10.31826	10.04512	6	9.95488
41	9.63689	26	36311	68206	33	31794	04518	6	95482
42	9.63715	26	36285	68239	32	31761	04524	6	95476
43	9.63741	26	36259	68271	32	31729	04530	6	95470
44	9.63767	27	36233	68303	33	31697	04536	6	95464
45	9.63794	26	10.36206	9.68336	32	10.31664	10.04542	6	9.95458
46	9.63820	26	36180	68368	32	31632	04548	6	95452
47	9.63846	26	36154	68400	32	31600	04554	6	95446
48	9.63872	26	36128	68432	33	31568	04560	6	95440
49	9.63898	26	36102	68465	33	31535	04566	7	95434
50	9.63924	26	10.36076	9.68497	32	10.31503	10.04573	6	9.95427
51	9.63950	26	36050	68529	32	31471	04579	6	95421
52	9.63976	26	36024	68561	32	31439	04585	6	95415
53	9.64002	26	35998	68593	32	31407	04591	6	95409
54	9.64028	26	35972	68626	33	31374	04597	6	95403
55	9.64054	26	10.35946	9.68658	32	10.31342	10.04603	6	9.95397
56	9.64080	26	35920	68690	32	31310	04609	7	95391
57	9.64106	26	35894	68722	32	31278	04616	6	95384
58	9.64132	26	35868	68754	32	31246	04622	6	95378
59	9.64158	26	35842	68786	32	31214	04628	6	95372
60	9.64184	26	10.35816	9.68818	32	10.31182	10.04634	6	9.95366

1

Logarithms of Trigonometric Functions

26°	sin	Diff 1'	csc	tan	Diff 1'	col	sec	Diff 1'	cos	+153°
0	9.64184	26	10.35816	9.68818	32	10.31182	10.04634	6	9.95366	60
1	6.4210	26	35790	68850	32	31150	0.1640	6	9.95360	59
2	6.4236	26	35764	68882	32	31118	0.1646	6	9.95354	58
3	6.4262	26	35738	68911	32	31086	0.1652	7	9.95348	57
4	6.4288	25	35712	68946	32	31051	0.1659	7	9.95341	56
5	9.04313	25	35687	9.68978	32	10.31022	10.01665	6	9.95335	55
6	6.4339	26	35661	69010	32	30990	0.1671	6	9.95329	54
7	6.4365	26	35635	69042	32	30958	0.1677	6	9.95323	53
8	6.4391	26	35609	69074	32	30926	0.1683	7	9.95317	52
9	6.4417	25	35583	69106	32	30891	0.1690	7	9.95310	51
10	9.61442	25	35558	9.09138	32	10.30862	10.04696	6	9.95304	50
11	6.1468	26	35532	69170	32	30830	0.1702	6	9.95298	49
12	6.1494	25	35506	69202	32	30798	0.1708	6	9.95292	48
13	6.1519	26	35481	69231	32	30766	0.1714	7	9.95286	47
14	6.1545	26	35455	69266	32	30734	0.1721	6	9.95279	46
15	9.64571	25	35429	9.69298	31	10.30702	10.04727	6	9.95273	45
16	6.1596	26	35404	69329	32	30671	0.1723	6	9.95267	44
17	6.1622	25	35378	69361	32	30639	0.1739	7	9.95261	43
18	6.1647	26	35353	69393	32	30607	0.1746	6	9.95254	42
19	6.1673	25	35327	69425	32	30575	0.1752	6	9.95248	41
20	9.61698	25	35302	9.69457	31	10.30543	10.04758	6	9.95242	40
21	6.1721	26	35276	69488	32	30512	0.1764	7	9.95236	39
22	6.1745	25	35251	69520	32	30480	0.1771	6	9.95229	38
23	6.1775	26	35225	69552	32	30448	0.1777	6	9.95223	37
24	6.1800	25	35200	69581	31	30416	0.1783	6	9.95217	36
25	9.64826	26	35174	9.69615	32	10.30385	10.04789	7	9.95211	35
26	6.1851	26	35149	69647	32	30353	0.1796	6	9.95204	34
27	6.1877	25	35123	69679	31	30321	0.1802	6	9.95198	33
28	6.1902	25	35098	69710	32	30290	0.1808	6	9.95192	32
29	6.1927	25	35073	69742	32	30258	0.1815	6	9.95185	31
30	9.64953	25	35047	9.69774	31	10.30226	10.04821	6	9.95179	30
31	6.1978	25	35022	69805	32	30195	0.1827	6	9.95173	29
32	6.5003	26	34997	69837	31	30163	0.1833	7	9.95167	28
33	6.5029	25	34971	69868	32	30132	0.1840	6	9.95160	27
34	6.5054	25	34946	69900	32	30100	0.1846	6	9.95154	26
35	9.65079	25	34921	9.69932	31	10.30068	10.04852	6	9.95148	25
36	6.5104	26	34896	69963	32	30037	0.1859	7	9.95141	24
37	6.5130	25	34870	69995	31	30005	0.1865	6	9.95135	23
38	6.5155	25	34845	70026	32	29974	0.1871	6	9.95129	22
39	6.5180	25	34820	70058	31	29942	0.1878	6	9.95122	21
40	9.65205	25	34795	9.70089	32	10.29911	10.04881	6	9.95116	20
41	6.5230	25	34770	70121	31	29879	0.1890	7	9.95110	19
42	6.5255	26	34745	70152	32	29848	0.1897	6	9.95103	18
43	6.5281	25	34719	70184	31	29816	0.1903	7	9.95097	17
44	6.5306	25	34691	70215	32	29785	0.1910	6	9.95090	16
45	9.65331	25	34669	9.70247	31	10.29753	10.04916	6	9.95084	15
46	6.5356	25	34644	70278	31	29722	0.1922	7	9.95078	14
47	6.5381	25	34619	70309	32	29691	0.1929	6	9.95071	13
48	6.5406	25	34594	70341	31	29659	0.1935	6	9.95065	12
49	6.5431	25	34569	70372	32	29628	0.1941	7	9.95059	11
50	9.65456	25	34544	9.70404	31	10.29596	10.04948	6	9.95052	10
51	6.5481	25	34519	70435	31	29565	0.1954	7	9.95046	9
52	6.5506	25	34494	70466	32	29531	0.1961	6	9.95039	8
53	6.5531	25	34469	70498	31	29502	0.1967	6	9.95033	7
54	6.5556	24	34444	70529	31	29471	0.1973	7	9.95027	6
55	9.65580	25	34420	9.70560	32	10.29440	10.04980	6	9.95020	5
56	6.5605	25	34395	70592	31	29408	0.1986	7	9.95014	4
57	6.5630	25	34370	70623	31	29377	0.1993	6	9.95007	3
58	6.5655	25	34345	70654	31	29346	0.1999	6	9.95001	2
59	6.5680	25	34320	70685	31	29315	0.5005	6	9.94995	1
60	9.65705	25	10.34295	9.70717	32	10.29283	10.05012	7	9.94988	0

16°

Diff
1'

sec

col

Diff
1'

tan

csc

Diff
1'

sin

63°

Logarithms of Trigonometric Functions

1

27° ↓	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos	152° ↓
0	9. 65705	24	10. 34295	9. 70717	31	10. 29283	10. 05012	6	9. 94988	60
1	65729	25	34271	70748	31	29252	05018	7	94982	59
2	65754	25	34246	70779	31	29221	05025	6	94975	58
3	65779	25	34221	70810	31	29190	05031	6	94969	57
4	65804	25	34196	70841	31	29159	05038	7	94962	56
5	9. 65828	24	10. 34172	9. 70873	32	10. 29127	10. 05044	6	9. 94956	55
6	65853	25	34147	70904	31	29096	05051	7	94949	54
7	65878	25	34122	70935	31	29065	05057	6	94943	53
8	65902	24	34098	70966	31	29034	05064	7	94936	52
9	65927	25	34073	70997	31	29003	05070	6	94930	51
10	9. 65952	25	10. 34048	9. 71028	31	10. 28972	10. 05077	7	9. 94923	50
11	65976	24	34024	71059	31	28941	05083	6	94917	49
12	66001	25	33999	71090	31	28910	05089	6	94911	48
13	66025	24	33975	71121	31	28879	05096	7	94904	47
14	66050	25	33950	71153	32	28847	05102	6	94898	46
15	9. 66075	25	10. 33925	9. 71184	31	10. 28816	10. 05109	7	9. 94891	45
16	66099	24	33901	71215	31	28785	05115	6	94885	44
17	66124	25	33876	71246	31	28754	05122	7	94878	43
18	66148	24	33852	71277	31	28723	05129	7	94871	42
19	66173	25	33827	71308	31	28692	05135	6	94865	41
20	9. 66197	24	10. 33803	9. 71339	31	10. 28661	10. 05142	7	9. 94858	40
21	66221	24	33779	71370	31	28630	05148	6	94852	39
22	66246	25	33754	71401	31	28599	05155	7	94845	38
23	66270	24	33730	71431	30	28569	05161	6	94839	37
24	66295	25	33705	71462	31	28538	05168	7	94832	36
25	9. 66319	24	10. 33681	9. 71493	31	10. 28507	10. 05174	6	9. 94826	35
26	66343	24	33657	71524	31	28476	05181	7	94819	34
27	66368	25	33632	71555	31	28445	05187	6	94813	33
28	66392	24	33608	71586	31	28414	05194	7	94806	32
29	66416	24	33584	71617	31	28383	05201	7	94799	31
30	9. 66441	25	10. 33559	9. 71648	31	10. 28352	10. 05207	6	9. 94793	30
31	66465	24	33535	71679	31	28321	05214	7	94786	29
32	66489	24	33511	71709	30	28291	05220	6	94780	28
33	66513	24	33487	71740	31	28260	05227	7	94773	27
34	66537	25	33463	71771	31	28229	05233	6	94767	26
35	9. 66562	24	10. 33438	9. 71802	31	10. 28198	10. 05240	7	9. 94760	25
36	66586	24	33414	71833	31	28167	05247	7	94753	24
37	66610	24	33390	71863	30	28137	05253	6	94747	23
38	66634	24	33366	71894	31	28106	05260	7	94740	22
39	66658	24	33342	71925	31	28075	05266	6	94734	21
40	9. 66682	24	10. 33318	9. 71955	30	10. 28045	10. 05273	7	9. 94727	20
41	66706	24	33294	71986	31	28014	05280	7	94720	19
42	66731	25	33269	72017	31	27983	05286	6	94714	18
43	66755	24	33245	72048	31	27952	05293	7	94707	17
44	66779	24	33221	72078	30	27922	05300	7	94700	16
45	9. 66803	24	10. 33197	9. 72109	31	10. 27891	10. 05306	6	9. 94694	15
46	66827	24	33173	72140	31	27860	05313	7	94687	14
47	66851	24	33149	72170	30	27830	05320	7	94680	13
48	66875	24	33125	72201	31	27799	05326	6	94674	12
49	66899	24	33101	72231	30	27769	05333	7	94667	11
50	9. 66922	23	10. 33078	9. 72262	31	10. 27738	10. 05340	7	9. 94660	10
51	66946	24	33054	72293	31	27707	05346	6	94654	9
52	66970	24	33030	72323	30	27677	05353	7	94647	8
53	66994	24	33006	72354	31	27646	05360	7	94640	7
54	67018	24	32982	72384	30	27616	05366	6	94634	6
55	9. 67042	24	10. 32958	9. 72415	31	10. 27585	10. 05373	7	9. 94627	5
56	67066	24	32934	72445	30	27555	05380	7	94620	4
57	67090	24	32910	72476	31	27524	05386	6	94614	3
58	67113	23	32887	72506	30	27494	05393	7	94607	2
59	67137	24	32863	72537	31	27463	05400	7	94600	1
60	9. 67161	24	10. 32839	9. 72567	30	10. 27433	10. 05407	7	9. 94593	0
↑ 117°	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin	↑ 62°

①

Logarithms of Trigonometric Functions

28° →	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos ← 151°	
0	9. 67161	24	10. 32839	9. 72567	31	10. 27433	10. 05407	6	9. 94593	60
1	. 67185	23	. 32815	. 72598	30	. 27402	. 05413	7	. 94587	59
2	. 67208	24	. 32792	. 72628	31	. 27372	. 05420	7	. 94580	58
3	. 67232	24	. 32768	. 72659	30	. 27341	. 05427	6	. 94573	57
4	. 67256	24	. 32744	. 72689	31	. 27311	. 05433	7	. 94567	56
5	9. 67280	23	10. 32720	9. 72720	30	10. 27280	10. 05440	7	9. 94560	55
6	. 67303	24	. 32697	. 72750	30	. 27250	. 05447	7	. 94553	54
7	. 67327	23	. 32673	. 72780	31	. 27220	. 05454	6	. 94546	53
8	. 67350	24	. 32650	. 72811	30	. 27189	. 05460	7	. 94540	52
9	. 67374	24	. 32626	. 72841	31	. 27159	. 05467	7	. 94533	51
10	9. 67398	23	10. 32602	9. 72872	30	10. 27128	10. 05474	7	9. 94526	50
11	. 67421	24	. 32579	. 72902	30	. 27098	. 05481	6	. 94519	49
12	. 67445	23	. 32555	. 72932	31	. 27068	. 05487	7	. 94513	48
13	. 67468	24	. 32532	. 72963	30	. 27037	. 05494	7	. 94506	47
14	. 67492	23	. 32508	. 72993	30	. 27007	. 05501	7	. 94499	46
15	9. 67515	24	10. 32485	9. 73023	31	10. 26977	10. 05508	7	9. 94492	45
16	. 67539	23	. 32461	. 73054	30	. 26946	. 05515	6	. 94485	44
17	. 67562	24	. 32438	. 73084	30	. 26916	. 05521	7	. 94479	43
18	. 67586	23	. 32414	. 73114	30	. 26886	. 05528	7	. 94472	42
19	. 67609	24	. 32391	. 73144	31	. 26856	. 05535	7	. 94465	41
20	9. 67633	23	10. 32367	9. 73175	30	10. 26825	10. 05542	7	9. 94458	40
21	. 67656	24	. 32344	. 73205	30	. 26795	. 05549	6	. 94451	39
22	. 67680	23	. 32320	. 73235	30	. 26765	. 05555	7	. 94445	38
23	. 67703	23	. 32297	. 73265	30	. 26735	. 05562	7	. 94438	37
24	. 67726	24	. 32274	. 73295	31	. 26705	. 05569	7	. 94431	36
25	9. 67750	23	10. 32250	9. 73326	30	10. 26674	10. 05576	7	9. 94424	35
26	. 67773	23	. 32227	. 73356	30	. 26644	. 05583	7	. 94417	34
27	. 67796	24	. 32204	. 73386	30	. 26614	. 05590	6	. 94410	33
28	. 67820	23	. 32180	. 73416	30	. 26584	. 05596	7	. 94404	32
29	. 67843	23	. 32157	. 73446	30	. 26554	. 05603	7	. 94397	31
30	9. 67866	24	10. 32134	9. 73476	31	10. 26524	10. 05610	7	9. 94390	30
31	. 67890	23	. 32110	. 73507	30	. 26493	. 05617	7	. 94383	29
32	. 67913	23	. 32087	. 73537	30	. 26463	. 05624	7	. 94376	28
33	. 67936	23	. 32064	. 73567	30	. 26433	. 05631	7	. 94369	27
34	. 67959	23	. 32041	. 73597	30	. 26403	. 05638	7	. 94362	26
35	9. 67982	24	10. 32018	9. 73627	30	10. 26373	10. 05645	6	9. 94355	25
36	. 68006	23	. 31994	. 73657	30	. 26343	. 05651	7	. 94349	24
37	. 68029	23	. 31971	. 73687	30	. 26313	. 05658	7	. 94342	23
38	. 68052	23	. 31948	. 73717	30	. 26283	. 05665	7	. 94335	22
39	. 68075	23	. 31925	. 73747	30	. 26253	. 05672	7	. 94328	21
40	9. 68098	23	10. 31902	9. 73777	30	10. 26223	10. 05679	7	9. 94321	20
41	. 68121	23	. 31879	. 73807	30	. 26193	. 05686	7	. 94314	19
42	. 68144	23	. 31856	. 73837	30	. 26163	. 05693	7	. 94307	18
43	. 68167	23	. 31833	. 73867	30	. 26133	. 05700	7	. 94300	17
44	. 68190	23	. 31810	. 73897	30	. 26103	. 05707	7	. 94293	16
45	9. 68213	24	10. 31787	9. 73927	30	10. 26073	10. 05714	7	9. 94286	15
46	. 68237	23	. 31763	. 73957	30	. 26043	. 05721	7	. 94279	14
47	. 68260	23	. 31740	. 73987	30	. 26013	. 05727	6	. 94273	13
48	. 68283	22	. 31717	. 74017	30	. 25983	. 05734	7	. 94266	12
49	. 68305	23	. 31695	. 74047	30	. 25953	. 05741	7	. 94259	11
50	9. 68328	23	10. 31672	9. 74077	30	10. 25923	10. 05748	7	9. 94252	10
51	. 68351	23	. 31649	. 74107	30	. 25893	. 05755	7	. 94245	9
52	. 68374	23	. 31626	. 74137	30	. 25863	. 05762	7	. 94238	8
53	. 68397	23	. 31603	. 74166	29	. 25834	. 05769	7	. 94231	7
54	. 68420	23	. 31580	. 74196	30	. 25804	. 05776	7	. 94224	6
55	9. 68443	23	10. 31557	9. 74226	30	10. 25774	10. 05783	7	9. 94217	5
56	. 68466	23	. 31534	. 74256	30	. 25744	. 05790	7	. 94210	4
57	. 68489	23	. 31511	. 74286	30	. 25714	. 05797	7	. 94203	3
58	. 68512	22	. 31488	. 74316	29	. 25684	. 05804	7	. 94196	2
59	. 68534	23	. 31466	. 74345	30	. 25655	. 05811	7	. 94189	1
60	9. 68557	23	10. 31443	9. 74375	30	10. 25625	10. 05818	7	9. 94182	0
↑ 118° →	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin	↑ 61°

Logarithms of Trigonometric Functions

29° ↑	sin	Diff. 1'	csc	tan	Diff. 1'	col	sec	Diff. 1'	cos →150° ↑
0	9.68557	23	10.31443	9.74375	30	10.25625	10.05818	7	9.94182
1	68580	23	31420	74405	30	25595	05825	7	94175
2	68603	22	31397	74435	30	25565	05832	7	94168
3	68625	23	31375	74465	29	25535	05839	7	94161
4	68648	23	31352	74494	30	25506	05846	7	94154
5	9.68671	23	10.31329	9.74524	30	10.25476	10.05853	7	9.94147
6	68694	22	31306	74554	29	25446	05860	7	94140
7	68716	23	31284	74583	30	25417	05867	7	94133
8	68739	23	31261	74613	30	25387	05874	7	94126
9	68762	22	31238	74643	30	25357	05881	7	94119
10	9.68784	23	10.31216	9.74673	29	10.25327	10.05888	7	9.94112
11	68807	22	31193	74702	30	25298	05895	7	94105
12	68829	23	31171	74732	30	25268	05902	7	94098
13	68852	23	31148	74762	29	25238	05910	7	94090
14	68875	22	31125	74791	30	25209	05917	7	94083
15	9.68897	23	10.31103	9.74821	30	10.25179	10.05924	7	9.94076
16	68920	22	31080	74851	29	25149	05931	7	94069
17	68942	23	31058	74880	30	25120	05938	7	94062
18	68965	23	31035	74910	29	25090	05945	7	94055
19	68987	22	31013	74939	30	25061	05952	7	94048
20	9.69010	22	10.30990	9.74969	29	10.25031	10.05959	7	9.94041
21	69032	23	30968	74998	30	25002	05966	7	94034
22	69055	22	30945	75028	30	24972	05973	7	94027
23	69077	23	30923	75058	29	24942	05980	7	94020
24	69100	22	30900	75087	30	24913	05988	7	94012
25	9.69122	22	10.30878	9.75117	29	10.24883	10.05995	7	9.94005
26	69144	23	30856	75146	30	24854	06002	7	93998
27	69167	22	30833	75176	29	24824	06009	7	93991
28	69189	23	30811	75205	30	24795	06016	7	93984
29	69212	22	30788	75235	29	24765	06023	7	93977
30	9.69234	22	10.30766	9.75264	30	10.24736	10.06030	7	9.93970
31	69256	23	30744	75294	29	24706	06037	7	93963
32	69279	22	30721	75323	30	24677	06045	7	93955
33	69301	22	30699	75353	29	24647	06052	7	93948
34	69323	22	30677	75382	29	24618	06059	7	93941
35	9.69345	23	10.30655	9.75411	30	10.24589	10.06066	7	9.93934
36	69368	22	30632	75441	29	24559	06073	7	93927
37	69390	22	30610	75470	30	24530	06080	7	93920
38	69412	22	30588	75500	29	24500	06088	7	93912
39	69434	22	30566	75529	29	24471	06095	7	93905
40	9.69456	23	10.30544	9.75558	30	10.24442	10.06102	7	9.93898
41	69479	22	30521	75588	29	24412	06109	7	93891
42	69501	22	30499	75617	30	24383	06116	7	93884
43	69523	22	30477	75647	29	24353	06124	7	93876
44	69545	22	30455	75676	29	24324	06131	7	93869
45	9.69567	22	10.30433	9.75705	30	10.24295	10.06138	7	9.93862
46	69589	22	30411	75735	29	24265	06145	7	93855
47	69611	22	30389	75764	29	24236	06153	7	93847
48	69633	22	30367	75793	29	24207	06160	7	93840
49	69655	22	30345	75822	30	24178	06167	7	93833
50	9.69677	22	10.30323	9.75852	29	10.24148	10.06174	7	9.93826
51	69699	22	30301	75881	29	24119	06181	7	93819
52	69721	22	30279	75910	29	24090	06189	7	93811
53	69743	22	30257	75939	30	24061	06196	7	93804
54	69765	22	30235	75969	29	24031	06203	7	93797
55	9.69787	22	10.30213	9.75998	29	10.24002	10.06211	7	9.93789
56	69809	22	30191	76027	29	23973	06218	7	93782
57	69831	22	30169	76056	30	23944	06225	7	93775
58	69853	22	30147	76086	29	23914	06232	7	93768
59	69875	22	30125	76115	29	23885	06240	7	93760
60	9.69897	22	10.30103	9.76144	29	10.23856	10.06247	7	9.93753

190° ← cos Diff. 1' sec tan Diff. 1' csc Diff. 1' sin → 60°

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Logarithms of Trigonometric Functions

30° ↓	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos ←149° ↓	
0	9.69897	22	10.30103	9.76144	29	10.23856	10.06247	7	9.93753	60
1	69919	22	30081	76173	29	23827	.06254	8	.93746	59
2	69941	22	30059	76202	29	23798	.06262	7	.93738	58
3	69963	21	30037	76231	30	23769	.06269	7	.93731	57
4	69984	22	30016	76261	29	23739	.06276	7	.93724	56
5	9.70006	22	10.29994	9.76290	29	10.23710	10.06283	8	9.93717	55
6	70028	22	29972	76319	29	23681	.06291	7	.93709	54
7	70050	22	29950	76348	29	23652	.06298	7	.93702	53
8	70072	21	29928	76377	29	23623	.06305	8	.93695	52
9	70093	22	29907	76406	29	23594	.06313	7	.93687	51
10	9.70115	22	10.29885	9.76435	29	10.23565	10.06320	7	9.93680	50
11	70137	22	29863	76464	29	23536	.06327	8	.93673	49
12	70159	21	29841	76493	29	23507	.06335	7	.93665	48
13	70180	22	29820	76522	29	23478	.06342	8	.93658	47
14	70202	22	29798	76551	29	23449	.06350	7	.93650	46
15	9.70224	21	10.29776	9.76580	29	10.23420	10.06357	7	9.93643	45
16	70245	22	29755	76609	30	23391	.06364	8	.93636	44
17	70267	21	29733	76639	29	23361	.06372	7	.93628	43
18	70288	22	29712	76668	29	23332	.06379	7	.93621	42
19	70310	22	29690	76697	28	23303	.06386	8	.93614	41
20	9.70332	21	10.29668	9.76725	29	10.23275	10.06394	7	9.93606	40
21	70353	22	29647	76754	29	23246	.06401	8	.93599	39
22	70375	21	29625	76783	29	23217	.06409	7	.93591	38
23	70396	22	29604	76812	29	23188	.06416	7	.93584	37
24	70418	21	29582	76841	29	23159	.06423	8	.93577	36
25	9.70439	22	10.29561	9.76870	29	10.23130	10.06431	7	9.93569	35
26	70461	21	29539	76899	29	23101	.06438	8	.93562	34
27	70482	22	29518	76928	29	23072	.06446	7	.93554	33
28	70504	21	29496	76957	29	23043	.06453	8	.93547	32
29	70525	22	29475	76986	29	23014	.06461	7	.93539	31
30	9.70547	21	10.29453	9.77015	29	10.22985	10.06468	7	9.93532	30
31	70568	22	29432	77044	29	22956	.06475	8	.93525	29
32	70590	21	29410	77073	29	22927	.06483	7	.93517	28
33	70611	22	29389	77101	28	22899	.06490	8	.93510	27
34	70633	21	29367	77130	29	22870	.06498	7	.93502	26
35	9.70654	21	10.29346	9.77159	29	10.22841	10.06505	8	9.93495	25
36	70675	22	29325	77188	29	22812	.06513	7	.93487	24
37	70697	21	29303	77217	29	22783	.06520	8	.93480	23
38	70718	21	29282	77246	29	22754	.06528	7	.93472	22
39	70739	22	29261	77274	28	22726	.06535	8	.93465	21
40	9.70761	21	10.29239	9.77303	29	10.22697	10.06543	7	9.93457	20
41	70782	21	29218	77332	29	22668	.06550	8	.93450	19
42	70803	21	29197	77361	29	22639	.06558	7	.93442	18
43	70824	22	29176	77390	29	22610	.06565	8	.93435	17
44	70846	21	29154	77418	29	22582	.06573	7	.93427	16
45	9.70867	21	10.29133	9.77447	29	10.22553	10.06580	8	9.93420	15
46	70888	21	29112	77476	29	22524	.06588	7	.93412	14
47	70909	21	29091	77505	29	22495	.06595	8	.93405	13
48	70931	22	29069	77533	28	22467	.06603	7	.93397	12
49	70952	21	29048	77562	29	22438	.06610	8	.93390	11
50	9.70973	21	10.29027	9.77591	28	10.22409	10.06618	7	9.93382	10
51	70994	21	29006	77619	29	22381	.06625	8	.93375	9
52	71015	21	28985	77648	29	22352	.06633	7	.93367	8
53	71036	22	28964	77677	29	22323	.06640	8	.93360	7
54	71058	21	28942	77706	28	22294	.06648	8	.93352	6
55	9.71079	21	10.28921	9.77734	29	10.22266	10.06656	7	9.93344	5
56	71100	21	28900	77763	28	22237	.06663	8	.93337	4
57	71121	21	28879	77791	29	22209	.06671	7	.93329	3
58	71142	21	28858	77820	29	22180	.06678	8	.93322	2
59	71163	21	28837	77849	28	22151	.06686	7	.93314	1
60	9.71184	21	10.28816	9.77877		10.22123	10.06693		9.93307	0
120° ↑	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin ←59° ↑	

Logarithms of Trigonometric Functions

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31° →	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos ← 148°	
0	9. 71184	21	10. 28816	9. 77877	29	10. 22123	10. 06693	8	9. 93307	60
1	71205	21	28795	77906	29	22094	06701	8	93299	59
2	71226	21	28774	77935	28	22065	06709	7	93291	58
3	71247	21	28753	77963	29	22037	06716	8	93284	57
4	71268	21	28732	77992	28	22008	06724	7	93276	56
5	9. 71289	21	10. 28711	9. 78020	29	10. 21980	10. 06731	8	9. 93269	55
6	71310	21	28690	78049	28	21951	06739	8	93261	54
7	71331	21	28669	78077	29	21923	06747	7	93253	53
8	71352	21	28648	78106	29	21894	06754	8	93246	52
9	71373	20	28627	78135	28	21865	06762	8	93238	51
10	9. 71393	21	10. 28607	9. 78163	29	10. 21837	10. 06770	7	9. 93230	50
11	71414	21	28586	78192	28	21808	06777	8	93223	49
12	71435	21	28565	78220	29	21780	06785	8	93215	48
13	71456	21	28544	78249	28	21751	06793	7	93207	47
14	71477	21	28523	78277	29	21723	06800	8	93200	46
15	9. 71498	21	10. 28502	9. 78306	28	10. 21694	10. 06808	8	9. 93192	45
16	71519	20	28481	78334	29	21666	06816	7	93184	44
17	71539	21	28461	78363	28	21637	06823	8	93177	43
18	71560	21	28440	78391	28	21609	06831	8	93169	42
19	71581	21	28419	78419	29	21581	06839	7	93161	41
20	9. 71602	20	10. 28398	9. 78448	28	10. 21552	10. 06846	8	9. 93154	40
21	71622	21	28378	78476	29	21524	06854	8	93146	39
22	71643	21	28357	78505	28	21495	06862	7	93138	38
23	71664	21	28336	78533	29	21467	06869	8	93131	37
24	71685	20	28315	78562	28	21438	06877	8	93123	36
25	9. 71705	21	10. 28295	9. 78590	28	10. 21410	10. 06885	7	9. 93115	35
26	71726	21	28274	78618	29	21382	06892	8	93108	34
27	71747	20	28253	78647	28	21353	06900	8	93100	33
28	71767	21	28233	78675	29	21325	06908	8	93092	32
29	71788	21	28212	78704	28	21296	06916	7	93084	31
30	9. 71809	20	10. 28191	9. 78732	28	10. 21268	10. 06923	8	9. 93077	30
31	71829	21	28171	78760	29	21240	06931	8	93069	29
32	71850	20	28150	78789	28	21211	06939	8	93061	28
33	71870	21	28130	78817	28	21183	06947	7	93053	27
34	71891	20	28109	78845	29	21155	06954	8	93046	26
35	9. 71911	21	10. 28089	9. 78874	28	10. 21126	10. 06962	8	9. 93038	25
36	71932	20	28068	78902	28	21098	06970	8	93030	24
37	71952	21	28048	78930	29	21070	06978	8	93022	23
38	71973	21	28027	78959	28	21041	06986	7	93014	22
39	71994	20	28006	78987	28	21013	06993	8	93007	21
40	9. 72014	20	10. 27986	9. 79015	28	10. 20985	10. 07001	8	9. 92999	20
41	72034	21	27966	79043	29	20957	07009	8	92991	19
42	72055	20	27945	79072	28	20928	07017	7	92983	18
43	72075	21	27925	79100	28	20900	07024	8	92976	17
44	72096	20	27904	79128	28	20872	07032	8	92968	16
45	9. 72116	21	10. 27884	9. 79156	29	10. 20844	10. 07040	8	9. 92960	15
46	72137	20	27863	79185	28	20815	07048	8	92952	14
47	72157	20	27843	79213	28	20787	07056	8	92944	13
48	72177	21	27823	79241	28	20759	07064	7	92936	12
49	72198	20	27802	79269	28	20731	07071	8	92929	11
50	9. 72218	20	10. 27782	9. 79297	29	10. 20703	10. 07079	8	9. 92921	10
51	72238	21	27762	79326	28	20674	07087	8	92913	9
52	72259	20	27741	79354	28	20646	07095	8	92905	8
53	72279	20	27721	79382	28	20618	07103	8	92897	7
54	72299	21	27701	79410	28	20590	07111	8	92889	6
55	9. 72320	20	10. 27680	9. 79438	28	10. 20562	10. 07119	7	9. 92881	5
56	72340	20	27660	79466	29	20534	07126	8	92874	4
57	72360	21	27640	79495	28	20505	07134	8	92866	3
58	72381	20	27619	79523	28	20477	07142	8	92858	2
59	72401	20	27599	79551	28	20449	07150	8	92850	1
60	9. 72421	20	10. 27579	9. 79579	28	10. 20421	10. 07158	8	9. 92842	0
121° →	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin ← 58°	

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Logarithms of Trigonometric Functions

32°→	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos ←147°	
↓										↓
0	9. 72421	20	10. 27579	9. 79579	28	10. 20421	10. 07158	8	9. 92842	60
1	72441	20	27559	79607	28	20393	07166	8	92834	59
2	72461	21	27539	79635	28	20365	07174	8	92826	58
3	72482	20	27518	79663	28	20337	07182	8	92818	57
4	72502	20	27498	79691	28	20309	07190	8	92810	56
5	9. 72522	20	10. 27478	9. 79719	28	10. 20281	10. 07197	8	9. 92803	55
6	72542	20	27458	79747	29	20253	07205	8	92795	54
7	72562	20	27438	79776	28	20224	07213	8	92787	53
8	72582	20	27418	79804	28	20196	07221	8	92779	52
9	72602	20	27398	79832	28	20168	07229	8	92771	51
10	9. 72622	21	10. 27378	9. 79860	28	10. 20140	10. 07237	8	9. 92763	50
11	72643	20	27357	79888	28	20112	07245	8	92755	49
12	72663	20	27337	79916	28	20084	07253	8	92747	48
13	72683	20	27317	79944	28	20056	07261	8	92739	47
14	72703	20	27297	79972	28	20028	07269	8	92731	46
15	9. 72723	20	10. 27277	9. 80000	28	10. 20000	10. 07277	8	9. 92723	45
16	72743	20	27257	80028	28	19972	07285	8	92715	44
17	72763	20	27237	80056	28	19944	07293	8	92707	43
18	72783	20	27217	80084	28	19916	07301	8	92699	42
19	72803	20	27197	80112	28	19888	07309	8	92691	41
20	9. 72823	20	10. 27177	9. 80140	28	10. 19860	10. 07317	8	9. 92683	40
21	72843	20	27157	80168	27	19832	07325	8	92675	39
22	72863	20	27137	80195	28	19805	07333	8	92667	38
23	72883	19	27117	80223	28	19777	07341	8	92659	37
24	72902	20	27098	80251	28	19749	07349	8	92651	36
25	9. 72922	20	10. 27078	9. 80279	28	10. 19721	10. 07357	8	9. 92643	35
26	72942	20	27058	80307	28	19693	07365	8	92635	34
27	72962	20	27038	80335	28	19665	07373	8	92627	33
28	72982	20	27018	80363	28	19637	07381	8	92619	32
29	73002	20	26998	80391	28	19609	07389	8	92611	31
30	9. 73022	19	10. 26978	9. 80419	28	10. 19581	10. 07397	8	9. 92603	30
31	73041	20	26959	80447	27	19553	07405	8	92595	29
32	73061	20	26939	80474	28	19526	07413	8	92587	28
33	73081	20	26919	80502	28	19498	07421	8	92579	27
34	73101	20	26899	80530	28	19470	07429	8	92571	26
35	9. 73121	19	10. 26879	9. 80558	28	10. 19442	10. 07437	8	9. 92563	25
36	73140	20	26860	80586	28	19414	07445	9	92555	24
37	73160	20	26840	80614	28	19386	07454	8	92546	23
38	73180	20	26820	80642	27	19358	07462	8	92538	22
39	73200	19	26800	80669	28	19331	07470	8	92530	21
40	9. 73219	20	10. 26781	9. 80697	28	10. 19303	10. 07478	8	9. 92522	20
41	73239	20	26761	80725	28	19275	07486	8	92514	19
42	73259	20	26741	80753	28	19247	07494	8	92506	18
43	73278	19	26722	80781	27	19219	07502	8	92498	17
44	73298	20	26702	80808	28	19192	07510	8	92490	16
45	9. 73318	19	10. 26682	9. 80836	28	10. 19164	10. 07518	9	9. 92482	15
46	73337	20	26663	80864	28	19136	07527	8	92473	14
47	73357	20	26643	80892	27	19108	07535	8	92465	13
48	73377	19	26623	80919	28	19081	07543	8	92457	12
49	73396	20	26604	80947	28	19053	07551	8	92449	11
50	9. 73416	19	10. 26584	9. 80975	28	10. 19025	10. 07559	8	9. 92441	10
51	73435	20	26565	81003	27	18997	07567	8	92433	9
52	73455	19	26545	81030	28	18970	07575	9	92425	8
53	73474	20	26526	81058	28	18942	07584	8	92416	7
54	73494	19	26506	81086	27	18914	07592	8	92408	6
55	9. 73513	20	10. 26487	9. 81113	28	10. 18887	10. 07600	8	9. 92400	5
56	73533	19	26467	81141	28	18859	07608	8	92392	4
57	73552	20	26448	81169	27	18831	07616	8	92384	3
58	73572	19	26428	81196	28	18804	07624	9	92376	2
59	73591	20	26409	81224	28	18776	07633	8	92367	1
60	9. 73611	20	10. 26389	9. 81252	28	10. 18748	10. 07641	8	9. 92359	0
↑ 122°→	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin	↑ +57°

Logarithms of Trigonometric Functions

1

33°→		Diff.	csc		Diff.	cot		Diff.	cos ←146°	
↓		1'			1'			1'	↓	
0	9. 73611	19	10. 26389	9. 81252	27	10. 18748	10. 07641	8	9. 92359	60
1	73630	20	26370	81279	28	18721	07649	8	92351	59
2	73650	19	26350	81307	28	18693	07657	8	92343	58
3	73669	20	26331	81335	27	18665	07665	9	92335	57
4	73689	19	26311	81362	28	18638	07674	8	92326	56
5	9. 73708	19	10. 26292	9. 81390	28	10. 18610	10. 07682	8	9. 92318	55
6	73727	20	26273	81418	27	18582	07690	8	92310	54
7	73747	19	26253	81445	28	18555	07698	9	92302	53
8	73766	19	26234	81473	27	18527	07707	8	92293	52
9	73785	20	26215	81500	28	18500	07715	8	92285	51
10	9. 73805	19	10. 26195	9. 81528	28	10. 18472	10. 07723	8	9. 92277	50
11	73824	19	26176	81556	27	18444	07731	9	92269	49
12	73843	20	26157	81583	28	18417	07740	8	92260	48
13	73863	19	26137	81611	27	18389	07748	8	92252	47
14	73882	19	26118	81638	28	18362	07756	9	92244	46
15	9. 73901	20	10. 26099	9. 81666	27	10. 18334	10. 07765	8	9. 92235	45
16	73921	19	26079	81693	28	18307	07773	8	92227	44
17	73940	19	26060	81721	27	18279	07781	8	92219	43
18	73959	19	26041	81748	28	18252	07789	9	92211	42
19	73978	19	26022	81776	27	18224	07798	8	92202	41
20	9. 73997	20	10. 26003	9. 81803	28	10. 18197	10. 07806	8	9. 92194	40
21	74017	19	25983	81831	27	18169	07814	9	92186	39
22	74036	19	25964	81858	28	18142	07823	8	92177	38
23	74055	19	25945	81886	27	18114	07831	8	92169	37
24	74074	19	25926	81913	28	18087	07839	9	92161	36
25	9. 74093	20	10. 25907	9. 81941	27	10. 18059	10. 07848	8	9. 92152	35
26	74113	19	25887	81968	28	18032	07856	8	92144	34
27	74132	19	25868	81996	27	18004	07864	9	92136	33
28	74151	19	25849	82023	28	17977	07873	8	92127	32
29	74170	19	25830	82051	27	17949	07881	8	92119	31
30	9. 74189	19	10. 25811	9. 82078	28	10. 17922	10. 07889	9	9. 92111	30
31	74208	19	25792	82106	27	17894	07898	8	92102	29
32	74227	19	25773	82133	28	17867	07906	8	92094	28
33	74246	19	25754	82161	27	17839	07914	9	92086	27
34	74265	19	25735	82188	27	17812	07923	8	92077	26
35	9. 74284	19	10. 25716	9. 82215	28	10. 17785	10. 07931	9	9. 92069	25
36	74303	19	25697	82243	27	17757	07940	8	92060	24
37	74322	19	25678	82270	28	17730	07948	8	92052	23
38	74341	19	25659	82298	27	17702	07956	9	92044	22
39	74360	19	25640	82325	27	17675	07965	8	92035	21
40	9. 74379	19	10. 25621	9. 82352	28	10. 17648	10. 07973	9	9. 92027	20
41	74398	19	25602	82380	27	17620	07982	8	92018	19
42	74417	19	25583	82407	28	17593	07990	8	92010	18
43	74436	19	25564	82435	27	17565	07998	9	92002	17
44	74455	19	25545	82462	27	17538	08007	8	91993	16
45	9. 74474	19	10. 25526	9. 82489	28	10. 17511	10. 08015	9	9. 91985	15
46	74493	19	25507	82517	27	17483	08024	8	91976	14
47	74512	19	25488	82544	27	17456	08032	9	91968	13
48	74531	19	25469	82571	28	17429	08041	8	91959	12
49	74549	18	25451	82599	27	17401	08049	9	91951	11
50	9. 74568	19	10. 25432	9. 82626	27	10. 17374	10. 08058	8	9. 91942	10
51	74587	19	25413	82653	28	17347	08066	9	91934	9
52	74606	19	25394	82681	27	17319	08075	8	91925	8
53	74625	19	25375	82708	27	17292	08083	9	91917	7
54	74644	18	25356	82735	27	17265	08092	8	91908	6
55	9. 74662	19	10. 25338	9. 82762	28	10. 17238	10. 08100	9	9. 91900	5
56	74681	19	25319	82790	27	17210	08109	8	91891	4
57	74700	19	25300	82817	27	17183	08117	9	91883	3
58	74719	19	25281	82844	27	17156	08126	8	91874	2
59	74737	18	25263	82871	27	17129	08134	9	91866	1
60	9. 74750	19	10. 25244	9. 82899	28	10. 17101	10. 08143	8	9. 91857	0
↑123°→		Diff.	sec		Diff.	tan		Diff.	sin ↑56°	
		1'			1'			1'		

1

Logarithms of Trigonometric Functions

34°→	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos ←145°
0	9.74756	19	10.25244	9.82899	27	10.17101	10.08143	8	9.91857
1	74775	19	25225	82926	27	17074	08151	9	91849
2	74794	18	25206	82953	27	17047	08160	8	91840
3	74812	19	25188	82980	27	17020	08168	9	91832
4	74831	19	25169	83008	27	16992	08177	8	91823
5	9.74850	18	10.25150	9.83035	27	10.16965	10.08185	9	9.91815
6	74868	19	25132	83062	27	16938	08194	8	91806
7	74887	19	25113	83089	27	16911	08202	9	91798
8	74906	18	25094	83117	27	16883	08211	8	91789
9	74924	19	25076	83144	27	16856	08219	9	91781
10	9.74943	18	10.25057	9.83171	27	10.16829	10.08228	9	9.91772
11	74961	19	25039	83198	27	16802	08237	8	91763
12	74980	19	25020	83225	27	16775	08245	9	91755
13	74999	19	25001	83252	28	16748	08254	8	91746
14	75017	19	24983	83280	27	16720	08262	9	91738
15	9.75036	18	10.24964	9.83307	27	10.16693	10.08271	9	9.91729
16	75054	19	24946	83334	27	16666	08280	8	91720
17	75073	18	24927	83361	27	16639	08288	9	91712
18	75091	18	24909	83388	27	16612	08297	8	91703
19	75110	19	24890	83415	27	16585	08305	9	91695
20	9.75128	19	10.24872	9.83442	28	10.16558	10.08314	9	9.91686
21	75147	18	24853	83470	27	16530	08323	8	91677
22	75165	19	24835	83497	27	16503	08331	9	91669
23	75184	18	24816	83524	27	16476	08340	8	91660
24	75202	19	24798	83551	27	16449	08349	9	91651
25	9.75221	18	10.24779	9.83578	27	10.16422	10.08357	9	9.91643
26	75239	19	24761	83605	27	16395	08366	8	91634
27	75258	18	24742	83632	27	16368	08375	9	91625
28	75276	18	24724	83659	27	16341	08383	8	91617
29	75294	19	24706	83686	27	16314	08392	9	91608
30	9.75313	18	10.24687	9.83713	27	10.16287	10.08401	8	9.91599
31	75331	19	24669	83740	28	16260	08409	9	91591
32	75350	18	24650	83768	27	16232	08418	8	91582
33	75368	18	24632	83795	27	16205	08427	9	91573
34	75386	19	24614	83822	27	16178	08435	8	91565
35	9.75405	18	10.24595	9.83849	27	10.16151	10.08444	9	9.91556
36	75423	18	24577	83876	27	16124	08453	8	91547
37	75441	18	24559	83903	27	16097	08462	9	91538
38	75459	19	24541	83930	27	16070	08470	8	91530
39	75478	18	24522	83957	27	16043	08479	9	91521
40	9.75496	18	10.24504	9.83984	27	10.16016	10.08488	8	9.91512
41	75514	19	24486	84011	27	15989	08496	9	91504
42	75533	18	24467	84038	27	15962	08505	8	91495
43	75551	18	24449	84065	27	15935	08514	9	91486
44	75569	18	24431	84092	27	15908	08523	8	91477
45	9.75587	18	10.24413	9.84119	27	10.15881	10.08531	9	9.91469
46	75605	19	24395	84146	27	15854	08540	8	91460
47	75624	18	24376	84173	27	15827	08549	9	91451
48	75642	18	24358	84200	27	15800	08558	8	91442
49	75660	18	24340	84227	27	15773	08567	9	91433
50	9.75678	18	10.24322	9.84254	26	10.15746	10.08575	8	9.91425
51	75696	18	24304	84280	27	15720	08584	9	91416
52	75714	19	24286	84307	27	15693	08593	8	91407
53	75733	18	24267	84334	27	15666	08602	9	91398
54	75751	18	24249	84361	27	15639	08611	8	91389
55	9.75769	18	10.24231	9.84388	27	10.15612	10.08619	9	9.91381
56	75787	18	24213	84415	27	15585	08628	8	91372
57	75805	18	24195	84442	27	15558	08637	9	91363
58	75823	18	24177	84469	27	15531	08646	8	91354
59	75841	18	24159	84496	27	15504	08655	9	91345
60	9.75859	18	10.24141	9.84523	27	10.15477	10.08664	9	9.91336
↑124°→	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin ←55°

Logarithms of Trigonometric Functions

Logarithms of Trigonometric Functions									
35° →	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos ← 144°
0	9.75859	18	10.24141	9.84523	27	10.15477	10.08664	8	9.91336
1	.75877	18	.24123	.84550	26	.15450	.08672	9	.91328
2	.75895	18	.24105	.84576	26	.15424	.08681	9	.91319
3	.75913	18	.24087	.84603	27	.15397	.08690	9	.91310
4	.75931	18	.24069	.84630	27	.15370	.08699	9	.91301
5	9.75949	18	10.24051	9.84657	27	10.15343	10.08708	9	9.91292
6	.75967	18	.24033	.84684	27	.15316	.08717	9	.91283
7	.75985	18	.24015	.84711	27	.15289	.08726	9	.91274
8	.76003	18	.23997	.84738	27	.15262	.08734	8	.91266
9	.76021	18	.23979	.84764	26	.15236	.08743	9	.91257
10	9.76039	18	10.23961	9.84791	27	10.15209	10.08752	9	9.91248
11	.76057	18	.23943	.84818	27	.15182	.08761	9	.91239
12	.76075	18	.23925	.84845	27	.15155	.08770	9	.91230
13	.76093	18	.23907	.84872	27	.15128	.08779	9	.91221
14	.76111	18	.23889	.84899	27	.15101	.08788	9	.91212
15	9.76129	17	10.23871	9.84925	26	10.15075	10.08797	9	9.91203
16	.76146	18	.23854	.84952	27	.15048	.08806	9	.91194
17	.76164	18	.23836	.84979	27	.15021	.08815	9	.91185
18	.76182	18	.23818	.85006	27	.14994	.08824	9	.91176
19	.76200	18	.23800	.85033	27	.14967	.08833	9	.91167
20	9.76218	18	10.23782	9.85059	26	10.14941	10.08842	9	9.91158
21	.76236	17	.23764	.85086	27	.14914	.08851	9	.91149
22	.76253	18	.23747	.85113	27	.14887	.08859	8	.91141
23	.76271	18	.23729	.85140	27	.14860	.08868	9	.91132
24	.76289	18	.23711	.85166	26	.14834	.08877	9	.91123
25	9.76307	17	10.23693	9.85193	27	10.14807	10.08886	9	9.91114
26	.76324	18	.23676	.85220	27	.14780	.08895	9	.91105
27	.76342	18	.23658	.85247	27	.14753	.08904	9	.91096
28	.76360	18	.23640	.85273	26	.14727	.08913	9	.91087
29	.76378	17	.23622	.85300	27	.14700	.08922	9	.91078
30	9.76395	18	10.23605	9.85327	27	10.14673	10.08931	9	9.91069
31	.76413	18	.23587	.85354	26	.14646	.08940	9	.91060
32	.76431	18	.23569	.85380	27	.14620	.08949	9	.91051
33	.76448	17	.23552	.85407	27	.14593	.08958	9	.91042
34	.76466	18	.23534	.85434	26	.14566	.08967	9	.91033
35	9.76484	17	10.23516	9.85460	27	10.14540	10.08977	10	9.91023
36	.76501	18	.23499	.85487	27	.14513	.08986	9	.91014
37	.76519	18	.23481	.85514	27	.14486	.08995	9	.91005
38	.76537	18	.23463	.85540	26	.14460	.09004	9	.90996
39	.76554	17	.23446	.85567	27	.14433	.09013	9	.90987
40	9.76572	18	10.23428	9.85594	27	10.14406	10.09022	9	9.90978
41	.76590	17	.23410	.85620	26	.14380	.09031	9	.90969
42	.76607	18	.23393	.85647	27	.14353	.09040	9	.90960
43	.76625	18	.23375	.85674	27	.14326	.09049	9	.90951
44	.76642	17	.23358	.85700	26	.14300	.09058	9	.90942
45	9.76660	18	10.23340	9.85727	27	10.14273	10.09067	9	9.90933
46	.76677	17	.23323	.85754	27	.14246	.09076	9	.90924
47	.76695	18	.23305	.85780	26	.14220	.09085	9	.90915
48	.76712	17	.23288	.85807	27	.14193	.09094	9	.90906
49	.76730	18	.23270	.85834	27	.14166	.09104	10	.90896
50	9.76747	17	10.23253	9.85860	26	10.14140	10.09113	9	9.90887
51	.76765	18	.23235	.85887	27	.14113	.09122	9	.90878
52	.76782	17	.23218	.85913	26	.14087	.09131	9	.90869
53	.76800	18	.23200	.85940	27	.14060	.09140	9	.90860
54	.76817	17	.23183	.85967	27	.14033	.09149	9	.90851
55	9.76835	18	10.23165	9.85993	26	10.14007	10.09158	9	9.90842
56	.76852	17	.23148	.86020	27	.13980	.09168	10	.90832
57	.76870	18	.23130	.86046	26	.13954	.09177	9	.90823
58	.76887	17	.23113	.86073	27	.13927	.09186	9	.90814
59	.76904	17	.23096	.86100	27	.13900	.09195	9	.90805
60	9.76922	18	10.23078	9.86126	26	10.13874	10.09204	9	9.90796
↑ 125° →	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin ← 54°

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Logarithms of Trigonometric Functions

36° ↓	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos +143° ↓
0	9. 76922	17	10. 23078	9. 86126	27	10. 13874	10. 09204	9	9. 90796
1	76939	18	23061	86153	26	13847	09213	10	90787
2	76957	17	23043	86179	27	13821	09223	9	90777
3	76974	17	23026	86206	26	13794	09232	9	90768
4	76991	18	23009	86232	27	13768	09241	9	90759
5	9. 77009	17	10. 22991	9. 86259	26	10. 13741	10. 09250	9	9. 90750
6	77026	17	22974	86285	27	13715	09259	10	90741
7	77043	17	22957	86312	26	13688	09269	9	90731
8	77061	17	22939	86338	27	13662	09278	9	90722
9	77078	17	22922	86365	27	13635	09287	9	90713
10	9. 77095	17	10. 22905	9. 86392	26	10. 13608	10. 09296	10	9. 90704
11	77112	18	22888	86418	27	13582	09306	9	90694
12	77130	17	22870	86445	26	13555	09315	9	90685
13	77147	17	22853	86471	27	13529	09324	9	90676
14	77164	17	22836	86498	26	13502	09333	10	90667
15	9. 77181	18	10. 22819	9. 86524	27	10. 13476	10. 09343	9	9. 90657
16	77199	17	22801	86551	26	13449	09352	9	90648
17	77216	17	22784	86577	26	13423	09361	9	90639
18	77233	17	22767	86603	27	13397	09370	10	90630
19	77250	18	22750	86630	26	13370	09380	9	90620
20	9. 77268	17	10. 22732	9. 86656	27	10. 13344	10. 09389	9	9. 90611
21	77285	17	22715	86683	26	13317	09398	10	90602
22	77302	17	22698	86709	27	13291	09408	9	90592
23	77319	17	22681	86736	26	13264	09417	9	90583
24	77336	17	22664	86762	27	13238	09426	9	90574
25	9. 77353	17	10. 22647	9. 86789	26	10. 13211	10. 09435	10	9. 90565
26	77370	17	22630	86815	27	13185	09445	9	90555
27	77387	17	22613	86842	26	13158	09454	9	90546
28	77405	18	22595	86868	26	13132	09463	10	90537
29	77422	17	22578	86894	27	13106	09473	9	90527
30	9. 77439	17	10. 22561	9. 86921	26	10. 13079	10. 09482	9	9. 90518
31	77456	17	22544	86947	27	13053	09491	10	90509
32	77473	17	22527	86974	26	13026	09501	9	90499
33	77490	17	22510	87000	27	13000	09510	10	90490
34	77507	17	22493	87027	26	12973	09520	9	90480
35	9. 77524	17	10. 22476	9. 87053	26	10. 12947	10. 09529	9	9. 90471
36	77541	17	22459	87079	27	12921	09538	10	90462
37	77558	17	22442	87106	26	12894	09548	9	90452
38	77575	17	22425	87132	26	12868	09557	9	90443
39	77592	17	22408	87158	27	12842	09566	10	90434
40	9. 77609	17	10. 22391	9. 87185	26	10. 12815	10. 09576	9	9. 90424
41	77626	17	22374	87211	27	12789	09585	10	90415
42	77643	17	22357	87238	26	12762	09595	9	90405
43	77660	17	22340	87264	26	12736	09604	10	90396
44	77677	17	22323	87290	27	12710	09614	9	90386
45	9. 77694	17	10. 22306	9. 87317	26	10. 12683	10. 09623	9	9. 90377
46	77711	17	22289	87343	26	12657	09632	10	90368
47	77728	17	22272	87369	27	12631	09642	9	90358
48	77744	16	22256	87396	26	12604	09651	10	90349
49	77761	17	22239	87422	26	12578	09661	9	90339
50	9. 77778	17	10. 22222	9. 87448	27	10. 12552	10. 09670	10	9. 90330
51	77795	17	22205	87475	26	12525	09680	9	90320
52	77812	17	22188	87501	26	12499	09689	10	90311
53	77829	17	22171	87527	27	12473	09699	9	90301
54	77846	16	22154	87554	26	12446	09708	10	90292
55	9. 77862	17	10. 22138	9. 87580	26	10. 12420	10. 09718	9	9. 90282
56	77879	17	22121	87606	27	12394	09727	10	90273
57	77896	17	22104	87633	26	12367	09737	9	90263
58	77913	17	22087	87659	26	12341	09746	10	90254
59	77930	16	22070	87685	26	12315	09756	9	90244
60	9. 77946	16	10. 22054	9. 87711	26	10. 12289	10. 09765	9	9. 90235
126° ↓	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin +53° ↑

Logarithms of Trigonometric Functions

1

37°→		sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos	←142°
0	9.77946	17	10.22054	9.87711	27	10.12289	10.09765	10	9.90235	60	
1	.77963	17	.22037	.87738	26	.12262	.09775	9	.90225	59	
2	.77980	17	.22020	.87764	26	.12236	.09781	10	.90216	58	
3	.77997	16	.22003	.87790	27	.12210	.09794	9	.90206	57	
4	.78013	17	.21987	.87817	26	.12183	.09803	10	.90197	56	
5	9.78030	17	10.21970	9.87843	26	10.12157	10.09813	9	9.90187	55	
6	.78047	16	.21953	.87869	26	.12131	.09822	10	.90178	54	
7	.78063	17	.21937	.87895	27	.12105	.09832	9	.90168	53	
8	.78080	17	.21920	.87922	26	.12078	.09841	10	.90159	52	
9	.78097	16	.21903	.87948	26	.12052	.09851	10	.90149	51	
10	9.78113	17	10.21887	9.87974	26	10.12026	10.09861	9	9.90139	50	
11	.78130	17	.21870	.88000	27	.12000	.09870	10	.90130	49	
12	.78147	16	.21853	.88027	26	.11973	.09880	9	.90120	48	
13	.78163	17	.21837	.88053	26	.11947	.09889	10	.90111	47	
14	.78180	17	.21820	.88079	26	.11921	.09899	10	.90101	46	
15	9.78197	16	10.21803	9.88105	26	10.11895	10.09909	9	9.90091	45	
16	.78213	17	.21787	.88131	27	.11869	.09918	10	.90082	44	
17	.78230	16	.21770	.88158	26	.11842	.09928	9	.90072	43	
18	.78246	17	.21754	.88184	26	.11816	.09937	10	.90063	42	
19	.78263	17	.21737	.88210	26	.11790	.09947	10	.90053	41	
20	9.78280	16	10.21720	9.88236	26	10.11764	10.09957	9	9.90043	40	
21	.78296	17	.21704	.88262	27	.11738	.09966	10	.90034	39	
22	.78313	16	.21687	.88289	26	.11711	.09976	10	.90024	38	
23	.78329	17	.21671	.88315	26	.11685	.09986	9	.90014	37	
24	.78346	16	.21654	.88341	26	.11659	.09995	10	.90005	36	
25	9.78362	17	10.21638	9.88367	26	10.11633	10.10005	10	9.89995	35	
26	.78379	16	.21621	.88393	27	.11607	.10015	9	.89985	34	
27	.78395	17	.21605	.88420	26	.11580	.10024	10	.89976	33	
28	.78412	16	.21588	.88446	26	.11554	.10034	10	.89966	32	
29	.78428	17	.21572	.88472	26	.11528	.10044	9	.89956	31	
30	9.78445	16	10.21555	9.88498	26	10.11502	10.10053	10	9.89947	30	
31	.78461	17	.21539	.88524	26	.11476	.10063	10	.89937	29	
32	.78478	16	.21522	.88550	27	.11450	.10073	9	.89927	28	
33	.78494	16	.21506	.88577	26	.11423	.10082	10	.89918	27	
34	.78510	17	.21490	.88603	26	.11397	.10092	10	.89908	26	
35	9.78527	16	10.21473	9.88629	26	10.11371	10.10102	10	9.89898	25	
36	.78543	17	.21457	.88655	26	.11345	.10112	9	.89888	24	
37	.78560	16	.21440	.88681	26	.11319	.10121	10	.89879	23	
38	.78576	16	.21424	.88707	26	.11293	.10131	10	.89869	22	
39	.78592	17	.21408	.88733	26	.11267	.10141	10	.89859	21	
40	9.78609	16	10.21391	9.88759	27	10.11241	10.10151	9	9.89849	20	
41	.78625	17	.21375	.88786	26	.11214	.10160	10	.89840	19	
42	.78642	16	.21358	.88812	26	.11188	.10170	10	.89830	18	
43	.78658	16	.21342	.88838	26	.11162	.10180	10	.89820	17	
44	.78674	17	.21326	.88864	26	.11136	.10190	9	.89810	16	
45	9.78691	16	10.21309	9.88890	26	10.11110	10.10199	10	9.89801	15	
46	.78707	16	.21293	.88916	26	.11084	.10209	10	.89791	14	
47	.78723	16	.21277	.88942	26	.11058	.10219	10	.89781	13	
48	.78739	16	.21261	.88968	26	.11032	.10229	10	.89771	12	
49	.78756	17	.21244	.88994	26	.11006	.10239	9	.89761	11	
50	9.78772	16	10.21228	9.89020	26	10.10980	10.10248	10	9.89752	10	
51	.78788	17	.21212	.89046	27	.10954	.10258	10	.89742	9	
52	.78805	16	.21195	.89073	26	.10927	.10268	10	.89732	8	
53	.78821	16	.21179	.89099	26	.10901	.10278	10	.89722	7	
54	.78837	16	.21163	.89125	26	.10875	.10288	10	.89712	6	
55	9.78853	16	10.21147	9.89151	26	10.10849	10.10298	9	9.89702	5	
56	.78869	17	.21131	.89177	26	.10823	.10307	10	.89693	4	
57	.78886	16	.21114	.89203	26	.10797	.10317	10	.89683	3	
58	.78902	16	.21098	.89229	26	.10771	.10327	10	.89673	2	
59	.78918	16	.21082	.89255	26	.10745	.10337	10	.89663	1	
60	9.78934	16	10.21066	9.89281	26	10.10719	10.10347	10	9.89653	0	
↑127°→		cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin	←52°

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Logarithms of Trigonometric Functions

38° ↓	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos	141° ↓
0	9. 78934	16	10. 21066	9. 89281	26.	10. 10719	10. 10347	10	9. 89653	60
1	. 78950	17	. 21050	. 89307	26	. 10693	. 10357	10	. 89643	59
2	. 78967	16	. 21033	. 89333	26	. 10667	. 10367	10	. 89633	58
3	. 78983	16	. 21017	. 89359	26	. 10641	. 10376	9	. 89624	57
4	. 78999	16	. 21001	. 89385	26	. 10615	. 10386	10	. 89614	56
5	9. 79015	16	10. 20985	9. 89411	26	10. 10589	10. 10396	10	9. 89604	55
6	. 79031	16	. 20969	. 89437	26	. 10563	. 10406	10	. 89594	54
7	. 79047	16	. 20953	. 89463	26	. 10537	. 10416	10	. 89584	53
8	. 79063	16	. 20937	. 89489	26	. 10511	. 10426	10	. 89574	52
9	. 79079	16	. 20921	. 89515	26	. 10485	. 10436	10	. 89564	51
10	9. 79095	16	10. 20905	9. 89541	26	10. 10459	10. 10446	10	9. 89554	50
11	. 79111	17	. 20889	. 89567	26	. 10433	. 10456	10	. 89544	49
12	. 79128	16	. 20872	. 89593	26	. 10407	. 10466	10	. 89534	48
13	. 79144	16	. 20856	. 89619	26	. 10381	. 10476	10	. 89524	47
14	. 79160	16	. 20840	. 89645	26	. 10355	. 10486	10	. 89514	46
15	9. 79176	16	10. 20824	9. 89671	26	10. 10329	10. 10496	9	9. 89504	45
16	. 79192	16	. 20808	. 89697	26	. 10303	. 10505	10	. 89495	44
17	. 79208	16	. 20792	. 89723	26	. 10277	. 10515	10	. 89485	43
18	. 79224	16	. 20776	. 89749	26	. 10251	. 10525	10	. 89475	42
19	. 79240	16	. 20760	. 89775	26	. 10225	. 10535	10	. 89465	41
20	9. 79256	16	10. 20744	9. 89801	26	10. 10199	10. 10545	10	9. 89455	40
21	. 79272	16	. 20728	. 89827	26	. 10173	. 10555	10	. 89445	39
22	. 79288	16	. 20712	. 89853	26	. 10147	. 10565	10	. 89435	38
23	. 79304	16	. 20696	. 89879	26	. 10121	. 10575	10	. 89425	37
24	. 79319	15	. 20681	. 89905	26	. 10095	. 10585	10	. 89415	36
25	9. 79335	16	10. 20665	9. 89931	26	10. 10069	10. 10595	10	9. 89405	35
26	. 79351	16	. 20649	. 89957	26	. 10043	. 10605	10	. 89395	34
27	. 79367	16	. 20633	. 89983	26	. 10017	. 10615	10	. 89385	33
28	. 79383	16	. 20617	. 90009	26	. 09991	. 10625	10	. 89375	32
29	. 79399	16	. 20601	. 90035	26	. 09965	. 10636	10	. 89364	31
30	9. 79415	16	10. 20585	9. 90061	25	10. 09939	10. 10646	10	9. 89354	30
31	. 79431	16	. 20569	. 90086	26	. 09914	. 10656	10	. 89344	29
32	. 79447	16	. 20553	. 90112	26	. 09888	. 10666	10	. 89334	28
33	. 79463	16	. 20537	. 90138	26	. 09862	. 10676	10	. 89324	27
34	. 79478	15	. 20522	. 90164	26	. 09836	. 10686	10	. 89314	26
35	9. 79494	16	10. 20506	9. 90190	26	10. 09810	10. 10696	10	9. 89304	25
36	. 79510	16	. 20490	. 90216	26	. 09784	. 10706	10	. 89294	24
37	. 79526	16	. 20474	. 90242	26	. 09758	. 10716	10	. 89284	23
38	. 79542	16	. 20458	. 90268	26	. 09732	. 10726	10	. 89274	22
39	. 79558	15	. 20442	. 90294	26	. 09706	. 10736	10	. 89264	21
40	9. 79573	16	10. 20427	9. 90320	26	10. 09680	10. 10746	10	9. 89254	20
41	. 79589	16	. 20411	. 90346	25	. 09654	. 10756	11	. 89244	19
42	. 79605	16	. 20395	. 90371	26	. 09629	. 10767	10	. 89233	18
43	. 79621	16	. 20379	. 90397	26	. 09603	. 10777	10	. 89223	17
44	. 79636	15	. 20364	. 90423	26	. 09577	. 10787	10	. 89213	16
45	9. 79652	16	10. 20348	9. 90449	26	10. 09551	10. 10797	10	9. 89203	15
46	. 79668	16	. 20332	. 90475	26	. 09525	. 10807	10	. 89193	14
47	. 79684	16	. 20316	. 90501	26	. 09499	. 10817	10	. 89183	13
48	. 79699	15	. 20301	. 90527	26	. 09473	. 10827	11	. 89173	12
49	. 79715	16	. 20285	. 90553	25	. 09447	. 10838	10	. 89162	11
50	9. 79731	15	10. 20269	9. 90578	26	10. 09422	10. 10848	10	9. 89152	10
51	. 79746	16	. 20254	. 90604	26	. 09396	. 10858	10	. 89142	9
52	. 79762	16	. 20238	. 90630	26	. 09370	. 10868	10	. 89132	8
53	. 79778	16	. 20222	. 90656	26	. 09344	. 10878	10	. 89122	7
54	. 79793	15	. 20207	. 90682	26	. 09318	. 10888	11	. 89112	6
55	9. 79809	16	10. 20191	9. 90708	26	10. 09292	10. 10899	10	9. 89101	5
56	. 79825	15	. 20175	. 90734	25	. 09266	. 10909	10	. 89091	4
57	. 79840	16	. 20160	. 90759	26	. 09241	. 10919	10	. 89081	3
58	. 79856	16	. 20144	. 90785	26	. 09215	. 10929	11	. 89071	2
59	. 79872	16	. 20128	. 90811	26	. 09189	. 10940	10	. 89060	1
60	9. 79887	15	10. 20113	9. 90837	26	10. 09163	10. 10950	10	9. 89050	0
↑ 128°	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin	↑ 51°

Logarithms of Trigonometric Functions

1

39° ↓		sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos	←140° ↓
0	9.79887	16	10.20113	9.90837	26	10.09163	10.10950	10	9.89050	60	
1	.79903	15	.20097	.90863	26	.09137	.10960	10	.89040	59	
2	.79918	16	.20082	.90889	25	.09111	.10970	10	.89030	58	
3	.79934	16	.20066	.90914	26	.09086	.10980	11	.89020	57	
4	.79950	15	.20050	.90940	26	.09060	.10991	10	.89009	56	
5	9.79965	16	10.20035	9.90966	26	10.09034	10.11001	10	9.88999	55	
6	.79981	15	.20019	.90992	26	.09008	.11011	11	.88989	54	
7	.79996	16	.20004	.91018	25	.08982	.11022	10	.88978	53	
8	.80012	15	.19988	.91043	26	.08957	.11032	10	.88968	52	
9	.80027	16	.19973	.91069	26	.08931	.11042	10	.88958	51	
10	9.80043	15	10.19957	9.91095	26	10.08905	10.11052	11	9.88948	50	
11	.80058	16	.19942	.91121	26	.08879	.11063	10	.88937	49	
12	.80074	15	.19926	.91147	25	.08853	.11073	10	.88927	48	
13	.80089	16	.19911	.91172	26	.08828	.11083	11	.88917	47	
14	.80105	15	.19895	.91198	26	.08802	.11094	10	.88906	46	
15	9.80120	16	10.19880	9.91224	26	10.08776	10.11104	10	9.88896	45	
16	.80136	15	.19864	.91250	26	.08750	.11114	11	.88886	44	
17	.80151	15	.19849	.91276	25	.08724	.11125	10	.88875	43	
18	.80166	16	.19834	.91301	26	.08699	.11135	10	.88865	42	
19	.80182	15	.19818	.91327	26	.08673	.11145	11	.88855	41	
20	9.80197	16	10.19803	9.91353	26	10.08647	10.11156	10	9.88844	40	
21	.80213	15	.19787	.91379	25	.08621	.11166	10	.88834	39	
22	.80228	16	.19772	.91404	26	.08596	.11176	11	.88824	38	
23	.80244	15	.19756	.91430	26	.08570	.11187	10	.88813	37	
24	.80259	15	.19741	.91456	26	.08544	.11197	10	.88803	36	
25	9.80274	16	10.19726	9.91482	25	10.08518	10.11207	11	9.88793	35	
26	.80290	15	.19710	.91507	26	.08493	.11218	10	.88782	34	
27	.80305	15	.19695	.91533	26	.08467	.11228	11	.88772	33	
28	.80320	16	.19680	.91559	26	.08441	.11239	10	.88761	32	
29	.80336	15	.19664	.91585	25	.08415	.11249	10	.88751	31	
30	9.80351	15	10.19649	9.91610	26	10.08390	10.11259	11	9.88741	30	
31	.80366	16	.19634	.91636	26	.08364	.11270	10	.88730	29	
32	.80382	15	.19618	.91662	26	.08338	.11280	11	.88720	28	
33	.80397	15	.19603	.91688	25	.08312	.11291	10	.88709	27	
34	.80412	16	.19588	.91713	26	.08287	.11301	11	.88699	26	
35	9.80428	15	10.19572	9.91739	26	10.08261	10.11312	10	9.88688	25	
36	.80443	15	.19557	.91765	26	.08235	.11322	10	.88678	24	
37	.80458	15	.19542	.91791	25	.08209	.11332	11	.88668	23	
38	.80473	16	.19527	.91816	26	.08184	.11343	10	.88657	22	
39	.80489	15	.19511	.91842	26	.08158	.11353	11	.88647	21	
40	9.80504	15	10.19496	9.91868	25	10.08132	10.11364	10	9.88636	20	
41	.80519	15	.19481	.91893	26	.08107	.11374	11	.88626	19	
42	.80534	16	.19466	.91919	26	.08081	.11385	10	.88615	18	
43	.80550	15	.19450	.91945	26	.08055	.11395	11	.88605	17	
44	.80565	15	.19435	.91971	25	.08029	.11406	10	.88594	16	
45	9.80580	15	10.19420	9.91996	26	10.08004	10.11416	11	9.88584	15	
46	.80595	15	.19405	.92022	26	.07978	.11427	10	.88573	14	
47	.80610	15	.19390	.92048	25	.07952	.11437	11	.88563	13	
48	.80625	16	.19375	.92073	26	.07927	.11448	10	.88552	12	
49	.80641	15	.19359	.92099	26	.07901	.11458	11	.88542	11	
50	9.80656	15	10.19344	9.92125	25	10.07875	10.11469	10	9.88531	10	
51	.80671	15	.19329	.92150	26	.07850	.11479	11	.88521	9	
52	.80686	15	.19314	.92176	26	.07824	.11490	11	.88510	8	
53	.80701	15	.19299	.92202	25	.07798	.11501	10	.88499	7	
54	.80716	15	.19284	.92227	26	.07773	.11511	11	.88489	6	
55	9.80731	15	10.19269	9.92253	26	10.07747	10.11522	10	9.88478	5	
56	.80746	16	.19254	.92279	25	.07721	.11532	11	.88468	4	
57	.80762	15	.19238	.92304	26	.07696	.11543	10	.88457	3	
58	.80777	15	.19223	.92330	26	.07670	.11553	11	.88447	2	
59	.80792	15	.19208	.92356	25	.07644	.11564	11	.88436	1	
60	9.80807	15	10.19193	9.92381	25	10.07619	10.11575	11	9.88425	0	
↑129°	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin	←50° ↑	

1

Logarithms of Trigonometric Functions

40° ↓	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos ←139° ↓
0	9.80807	15	10.19193	9.92381	26	10.07619	10.11575	10	9.88425
1	80822	15	19178	92407	26	07593	11585	11	88415
2	80837	15	19163	92433	25	07567	11596	10	88404
3	80852	15	19148	92458	25	07542	11606	11	88394
4	80867	15	19133	92484	26	07516	11617	11	88383
5	80882	15	19118	92510	25	10.07490	10.11628	10	9.88372
6	80897	15	19103	92535	26	07465	11638	11	88362
7	80912	15	19088	92561	26	07439	11649	11	88351
8	80927	15	19073	92587	25	07413	11660	10	88340
9	80942	15	19058	92612	26	07388	11670	11	88330
10	80957	15	19043	92638	25	10.07362	10.11681	11	9.88319
11	80972	15	19028	92663	26	07337	11692	10	88308
12	80987	15	19013	92689	26	07311	11702	11	88298
13	81002	15	18998	92715	25	07285	11713	11	88287
14	81017	15	18983	92740	26	07260	11724	10	88276
15	81032	15	18968	92766	26	10.07234	10.11734	11	9.88266
16	81047	14	18953	92792	25	07208	11745	11	88255
17	81061	14	18939	92817	26	07183	11756	10	88244
18	81076	15	18924	92843	25	07157	11766	11	88234
19	81091	15	18909	92868	26	07132	11777	11	88223
20	81106	15	18894	92894	26	10.07106	10.11788	11	9.88212
21	81121	15	18879	92920	25	07080	11799	10	88201
22	81136	15	18864	92945	26	07055	11809	11	88191
23	81151	15	18849	92971	25	07029	11820	11	88180
24	81166	14	18834	92996	26	07004	11831	11	88169
25	81180	14	18820	93022	26	10.06978	10.11842	10	9.88158
26	81195	15	18805	93048	25	06952	11852	11	88148
27	81210	15	18790	93073	26	06927	11863	11	88137
28	81225	15	18775	93099	25	06901	11874	11	88126
29	81240	14	18760	93124	26	06876	11885	10	88115
30	81254	15	18746	93150	25	10.06850	10.11895	11	9.88105
31	81269	15	18731	93175	26	06825	11906	11	88094
32	81284	15	18716	93201	26	06799	11917	11	88083
33	81299	15	18701	93227	25	06773	11928	11	88072
34	81314	14	18686	93252	26	06748	11939	10	88061
35	81328	15	18672	93278	25	10.06722	10.11949	11	9.88051
36	81343	15	18657	93303	26	06697	11960	11	88040
37	81358	14	18642	93329	25	06671	11971	11	88029
38	81372	14	18628	93354	26	06646	11982	11	88018
39	81387	15	18613	93380	26	06620	11993	11	88007
40	81402	15	18598	93406	25	10.06594	10.12004	11	9.87996
41	81417	14	18583	93431	26	06569	12015	10	87985
42	81431	15	18569	93457	25	06543	12025	11	87975
43	81446	15	18554	93482	26	06518	12036	11	87964
44	81461	14	18539	93508	25	06492	12047	11	87953
45	81475	15	18525	93533	26	10.06467	10.12058	11	9.87942
46	81490	15	18510	93559	25	06441	12069	11	87931
47	81505	14	18495	93584	26	06416	12080	11	87920
48	81519	15	18481	93610	26	06390	12091	11	87909
49	81534	15	18466	93636	25	06364	12102	11	87898
50	81549	14	18451	93661	26	10.06339	10.12113	10	9.87887
51	81563	15	18437	93687	25	06313	12123	11	87877
52	81578	15	18422	93712	26	06288	12134	11	87866
53	81592	14	18408	93738	25	06262	12145	11	87855
54	81607	15	18393	93763	26	06237	12156	11	87844
55	81622	14	18378	93789	25	10.06211	10.12167	11	9.87833
56	81636	15	18364	93814	26	06186	12178	11	87822
57	81651	14	18349	93840	25	06160	12189	11	87811
58	81665	15	18335	93865	26	06135	12200	11	87800
59	81680	14	18320	93891	25	06109	12211	11	87789
60	81694	14	18306	93916	25	10.06084	10.12222	11	9.87778

Logarithms of Trigonometric Functions

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41° ↓	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos ←138° ↓
0	9. 81694	15	10. 18306	9. 93916	26	10. 06084	10. 12222	11	9. 87778
1	. 81709	14	. 18291	. 93942	25	. 06058	. 12233	11	. 87767
2	. 81723	15	. 18277	. 93967	26	. 06033	. 12244	11	. 87756
3	. 81738	14	. 18262	. 93993	25	. 06007	. 12255	11	. 87745
4	. 81752	15	. 18248	. 94018	26	. 05982	. 12266	11	. 87734
5	9. 81767	14	10. 18233	9. 94044	25	10. 05956	10. 12277	11	9. 87723
6	. 81781	15	. 18219	. 94069	26	. 05931	. 12288	11	. 87712
7	. 81796	14	. 18204	. 94095	25	. 05905	. 12299	11	. 87701
8	. 81810	15	. 18190	. 94120	26	. 05880	. 12310	11	. 87690
9	. 81825	14	. 18175	. 94146	25	. 05854	. 12321	11	. 87679
10	9. 81839	15	10. 18161	9. 94171	26	10. 05829	10. 12332	11	9. 87668
11	. 81854	14	. 18146	. 94197	25	. 05803	. 12343	11	. 87657
12	. 81868	15	. 18132	. 94222	26	. 05778	. 12354	11	. 87646
13	. 81882	14	. 18118	. 94248	25	. 05752	. 12365	11	. 87635
14	. 81897	15	. 18103	. 94273	26	. 05727	. 12376	11	. 87624
15	9. 81911	14	10. 18089	9. 94299	25	10. 05701	10. 12387	12	9. 87613
16	. 81926	15	. 18074	. 94324	26	. 05676	. 12399	11	. 87601
17	. 81940	14	. 18060	. 94350	25	. 05650	. 12410	11	. 87590
18	. 81955	15	. 18045	. 94375	26	. 05625	. 12421	11	. 87579
19	. 81969	14	. 18031	. 94401	25	. 05599	. 12432	11	. 87568
20	9. 81983	15	10. 18017	9. 94426	26	10. 05574	10. 12443	11	9. 87557
21	. 81998	14	. 18002	. 94452	25	. 05548	. 12454	11	. 87546
22	. 82012	15	. 17988	. 94477	26	. 05523	. 12465	11	. 87535
23	. 82026	14	. 17974	. 94503	25	. 05497	. 12476	11	. 87524
24	. 82041	15	. 17959	. 94528	26	. 05472	. 12487	12	. 87513
25	9. 82055	14	10. 17945	9. 94554	25	10. 05446	10. 12499	11	9. 87501
26	. 82069	15	. 17931	. 94579	26	. 05421	. 12510	11	. 87490
27	. 82084	14	. 17916	. 94604	25	. 05396	. 12521	11	. 87479
28	. 82098	15	. 17902	. 94630	26	. 05370	. 12532	11	. 87468
29	. 82112	14	. 17888	. 94655	25	. 05345	. 12543	11	. 87457
30	9. 82126	15	10. 17874	9. 94681	26	10. 05319	10. 12554	12	9. 87446
31	. 82141	14	. 17859	. 94706	25	. 05294	. 12566	11	. 87434
32	. 82155	15	. 17845	. 94732	26	. 05268	. 12577	11	. 87423
33	. 82169	14	. 17831	. 94757	25	. 05243	. 12588	11	. 87412
34	. 82184	15	. 17816	. 94783	26	. 05217	. 12599	11	. 87401
35	9. 82198	14	10. 17802	9. 94808	25	10. 05192	10. 12610	12	9. 87390
36	. 82212	15	. 17788	. 94834	26	. 05166	. 12622	11	. 87378
37	. 82226	14	. 17774	. 94859	25	. 05141	. 12633	11	. 87367
38	. 82240	15	. 17760	. 94884	26	. 05116	. 12644	11	. 87356
39	. 82255	14	. 17745	. 94910	25	. 05090	. 12655	11	. 87345
40	9. 82269	15	10. 17731	9. 94935	26	10. 05065	10. 12666	12	9. 87334
41	. 82283	14	. 17717	. 94961	25	. 05039	. 12678	11	. 87322
42	. 82297	15	. 17703	. 94986	26	. 05014	. 12689	11	. 87311
43	. 82311	14	. 17689	. 95012	25	. 04988	. 12700	12	. 87300
44	. 82326	15	. 17674	. 95037	26	. 04963	. 12712	11	. 87288
45	9. 82340	14	10. 17660	9. 95062	25	10. 04938	10. 12723	11	9. 87277
46	. 82354	15	. 17646	. 95088	26	. 04912	. 12734	11	. 87266
47	. 82368	14	. 17632	. 95113	25	. 04887	. 12745	11	. 87255
48	. 82382	15	. 17618	. 95139	26	. 04861	. 12757	12	. 87243
49	. 82396	14	. 17604	. 95164	25	. 04836	. 12768	11	. 87232
50	9. 82410	15	10. 17590	9. 95190	26	10. 04810	10. 12779	12	9. 87221
51	. 82424	14	. 17576	. 95215	25	. 04785	. 12791	11	. 87209
52	. 82439	15	. 17561	. 95240	26	. 04760	. 12802	11	. 87198
53	. 82453	14	. 17547	. 95266	25	. 04734	. 12813	12	. 87187
54	. 82467	15	. 17533	. 95291	26	. 04709	. 12825	11	. 87175
55	9. 82481	14	10. 17519	9. 95317	25	10. 04683	10. 12836	11	9. 87164
56	. 82495	15	. 17505	. 95342	26	. 04658	. 12847	12	. 87153
57	. 82509	14	. 17491	. 95368	25	. 04632	. 12859	11	. 87141
58	. 82523	15	. 17477	. 95393	26	. 04607	. 12870	11	. 87130
59	. 82537	14	. 17463	. 95418	25	. 04582	. 12881	12	. 87119
60	9. 82551	15	10. 17449	9. 95444	26	10. 04556	10. 12893	12	9. 87107
↑131°	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin ←48° ↑

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Logarithms of Trigonometric Functions

42° →	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos ← 137°	
↓										↓
0	9. 82551	14	10. 17449	9. 95444	25	10. 04556	10. 12893	11	9. 87107	60
1	. 82565	14	. 17435	. 95469	26	. 04531	. 12904	11	. 87096	59
2	. 82579	14	. 17421	. 95495	25	. 04505	. 12915	12	. 87085	58
3	. 82593	14	. 17407	. 95520	25	. 04480	. 12927	11	. 87073	57
4	. 82607	14	. 17393	. 95545	26	. 04455	. 12938	12	. 87062	56
5	9. 82621	14	10. 17379	9. 95571	25	10. 04429	10. 12950	11	9. 87050	55
6	. 82635	14	. 17365	. 95596	26	. 04404	. 12961	11	. 87039	54
7	. 82649	14	. 17351	. 95622	25	. 04378	. 12972	12	. 87028	53
8	. 82663	14	. 17337	. 95647	25	. 04353	. 12984	11	. 87016	52
9	. 82677	14	. 17323	. 95672	26	. 04328	. 12995	12	. 87005	51
10	9. 82691	14	10. 17309	9. 95698	25	10. 04302	10. 13007	11	9. 86993	50
11	. 82705	14	. 17295	. 95723	25	. 04277	. 13018	12	. 86982	49
12	. 82719	14	. 17281	. 95748	26	. 04252	. 13030	11	. 86970	48
13	. 82733	14	. 17267	. 95774	25	. 04226	. 13041	12	. 86959	47
14	. 82747	14	. 17253	. 95799	26	. 04201	. 13053	11	. 86947	46
15	9. 82761	14	10. 17239	9. 95825	25	10. 04175	10. 13064	12	9. 86936	45
16	. 82775	13	. 17225	. 95850	25	. 04150	. 13076	11	. 86924	44
17	. 82788	14	. 17212	. 95875	26	. 04125	. 13087	11	. 86913	43
18	. 82802	14	. 17198	. 95901	25	. 04099	. 13098	12	. 86902	42
19	. 82816	14	. 17184	. 95926	26	. 04074	. 13110	11	. 86890	41
20	9. 82830	14	10. 17170	9. 95952	25	10. 04048	10. 13121	12	9. 86879	40
21	. 82844	14	. 17156	. 95977	25	. 04023	. 13133	12	. 86867	39
22	. 82858	14	. 17142	. 96002	26	. 03998	. 13145	11	. 86855	38
23	. 82872	13	. 17128	. 96028	25	. 03972	. 13156	12	. 86844	37
24	. 82885	14	. 17115	. 96053	25	. 03947	. 13168	11	. 86832	36
25	9. 82899	14	10. 17101	9. 96078	26	10. 03922	10. 13179	12	9. 86821	35
26	. 82913	14	. 17087	. 96104	25	. 03896	. 13191	11	. 86809	34
27	. 82927	14	. 17073	. 96129	26	. 03871	. 13202	12	. 86798	33
28	. 82941	14	. 17059	. 96155	25	. 03845	. 13214	11	. 86786	32
29	. 82955	13	. 17045	. 96180	25	. 03820	. 13225	12	. 86775	31
30	9. 82968	14	10. 17032	9. 96205	26	10. 03795	10. 13237	11	9. 86763	30
31	. 82982	14	. 17018	. 96231	25	. 03769	. 13248	12	. 86752	29
32	. 82996	14	. 17004	. 96256	25	. 03744	. 13260	12	. 86740	28
33	. 83010	13	. 16990	. 96281	26	. 03719	. 13272	11	. 86728	27
34	. 83023	14	. 16977	. 96307	25	. 03693	. 13283	12	. 86717	26
35	9. 83037	14	10. 16963	9. 96332	25	10. 03668	10. 13295	11	9. 86705	25
36	. 83051	14	. 16949	. 96357	26	. 03643	. 13306	12	. 86694	24
37	. 83065	13	. 16935	. 96383	25	. 03617	. 13318	12	. 86682	23
38	. 83078	14	. 16922	. 96408	25	. 03592	. 13330	11	. 86670	22
39	. 83092	14	. 16908	. 96433	26	. 03567	. 13341	12	. 86659	21
40	9. 83106	14	10. 16894	9. 96459	25	10. 03541	10. 13353	12	9. 86647	20
41	. 83120	13	. 16880	. 96484	26	. 03516	. 13365	11	. 86635	19
42	. 83133	14	. 16867	. 96510	25	. 03490	. 13376	12	. 86624	18
43	. 83147	14	. 16853	. 96535	25	. 03465	. 13388	12	. 86612	17
44	. 83161	13	. 16839	. 96560	26	. 03440	. 13400	11	. 86600	16
45	9. 83174	14	10. 16826	9. 96586	25	10. 03414	10. 13411	12	9. 86589	15
46	. 83188	14	. 16812	. 96611	25	. 03389	. 13423	12	. 86577	14
47	. 83202	13	. 16798	. 96636	26	. 03364	. 13435	11	. 86565	13
48	. 83215	14	. 16785	. 96662	25	. 03338	. 13446	12	. 86554	12
49	. 83229	13	. 16771	. 96687	25	. 03313	. 13458	12	. 86542	11
50	9. 83242	14	10. 16758	9. 96712	26	10. 03288	10. 13470	12	9. 86530	10
51	. 83256	14	. 16744	. 96738	25	. 03262	. 13482	11	. 86518	9
52	. 83270	13	. 16730	. 96763	25	. 03237	. 13493	12	. 86507	8
53	. 83283	14	. 16717	. 96788	26	. 03212	. 13505	12	. 86495	7
54	. 83297	13	. 16703	. 96814	25	. 03186	. 13517	11	. 86483	6
55	9. 83310	14	10. 16690	9. 96839	25	10. 03161	10. 13528	12	9. 86472	5
56	. 83324	14	. 16676	. 96864	26	. 03136	. 13540	12	. 86460	4
57	. 83338	13	. 16662	. 96890	25	. 03110	. 13552	12	. 86448	3
58	. 83351	14	. 16649	. 96915	25	. 03085	. 13564	11	. 86436	2
59	. 83365	13	. 16635	. 96940	26	. 03060	. 13575	12	. 86425	1
60	9. 83378	13	10. 16622	9. 96966	26	10. 03034	10. 13587	12	9. 86413	0
↑ 132° →	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin ← 47°	↑

Logarithms of Trigonometric Functions

1

43°→		sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos	←136°
↓											↓
0	9.83378	14	10.16622	9.96966	25	10.03034	10.13587	12	9.86413	60	
1	83392	13	16608	96991	25	03009	13599	12	86401	59	
2	83405	14	16595	97016	26	02984	13611	12	86389	58	
3	83419	13	16581	97042	25	02958	13623	12	86377	57	
4	83432	14	16568	97067	25	02933	13634	11	86366	56	
5	9.83446	13	10.16554	9.97092	26	10.02908	10.13646	12	9.86354	55	
6	83459	14	16541	97118	25	02882	13658	12	86342	54	
7	83473	13	16527	97143	25	02857	13670	12	86330	53	
8	83486	14	16514	97168	25	02832	13682	12	86318	52	
9	83500	13	16500	97193	26	02807	13694	11	86306	51	
10	9.83513	14	10.16487	9.97219	25	10.02781	10.13705	12	9.86295	50	
11	83527	13	16473	97244	25	02756	13717	12	86283	49	
12	83540	14	16460	97269	26	02731	13729	12	86271	48	
13	83554	13	16446	97295	25	02705	13741	12	86259	47	
14	83567	14	16433	97320	25	02680	13753	12	86247	46	
15	9.83581	13	10.16419	9.97345	26	10.02655	10.13765	12	9.86235	45	
16	83594	14	16406	97371	25	02629	13777	12	86223	44	
17	83608	13	16392	97396	25	02604	13789	11	86211	43	
18	83621	13	16379	97421	26	02579	13800	12	86200	42	
19	83634	14	16366	97447	25	02553	13812	12	86188	41	
20	9.83648	13	10.16352	9.97472	25	10.02528	10.13824	12	9.86176	40	
21	83661	13	16339	97497	26	02503	13836	12	86164	39	
22	83674	14	16326	97523	25	02477	13848	12	86152	38	
23	83688	13	16312	97548	25	02452	13860	12	86140	37	
24	83701	14	16299	97573	25	02427	13872	12	86128	36	
25	9.83715	13	10.16285	9.97598	26	10.02402	10.13884	12	9.86116	35	
26	83728	13	16272	97624	25	02376	13896	12	86104	34	
27	83741	14	16259	97649	25	02351	13908	12	86092	33	
28	83755	13	16245	97674	26	02326	13920	12	86080	32	
29	83768	13	16232	97700	25	02300	13932	12	86068	31	
30	9.83781	14	10.16219	9.97725	25	10.02275	10.13944	12	9.86056	30	
31	83795	13	16205	97750	26	02250	13956	12	86044	29	
32	83808	13	16192	97776	25	02224	13968	12	86032	28	
33	83821	13	16179	97801	25	02199	13980	12	86020	27	
34	83834	14	16166	97826	25	02174	13992	12	86008	26	
35	9.83848	13	10.16152	9.97851	26	10.02149	10.14004	12	9.85996	25	
36	83861	13	16139	97877	25	02123	14016	12	85984	24	
37	83874	13	16126	97902	25	02098	14028	12	85972	23	
38	83887	13	16113	97927	26	02073	14040	12	85960	22	
39	83901	14	16099	97953	25	02047	14052	12	85948	21	
40	9.83914	13	10.16086	9.97978	25	10.02022	10.14064	12	9.85936	20	
41	83927	13	16073	98003	26	01997	14076	12	85924	19	
42	83940	14	16060	98029	25	01971	14088	12	85912	18	
43	83954	13	16046	98054	25	01946	14100	12	85900	17	
44	83967	13	16033	98079	25	01921	14112	12	85888	16	
45	9.83980	13	10.16020	9.98104	26	10.01896	10.14124	12	9.85876	15	
46	83993	13	16007	98130	25	01870	14136	13	85864	14	
47	84006	14	15994	98155	25	01845	14149	12	85851	13	
48	84020	13	15980	98180	25	01820	14161	12	85839	12	
49	84033	13	15967	98206	26	01794	14173	12	85827	11	
50	9.84046	13	10.15954	9.98231	25	10.01769	10.14185	12	9.85815	10	
51	84059	13	15941	98256	25	01744	14197	12	85803	9	
52	84072	13	15928	98281	26	01719	14209	12	85791	8	
53	84085	13	15915	98307	25	01693	14221	13	85779	7	
54	84098	14	15902	98332	25	01668	14234	12	85766	6	
55	84112	13	10.15888	9.98357	26	10.01643	10.14246	12	9.85754	5	
56	84125	13	15875	98383	25	01617	14258	12	85742	4	
57	84138	13	15862	98408	25	01592	14270	12	85730	3	
58	84151	13	15849	98433	25	01567	14282	12	85718	2	
59	84164	13	15836	98458	25	01542	14294	13	85706	1	
60	9.84177	13	10.15823	9.98484	26	10.01516	10.14307	13	9.85693	0	
↑133°→		cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin	←46°
											↑

1

Logarithms of Trigonometric Functions

44°→ ↓	sin	Diff. 1'	csc	tan	Diff. 1'	cot	sec	Diff. 1'	cos ←135° ↓
0	9. 84177	13	10. 15823	9. 98484	25	10. 01516	10. 14307	12	9. 85693
1	. 84190	13	. 15810	. 98509	25	. 01491	. 14319	12	. 85681
2	. 84203	13	. 15797	. 98534	26	. 01466	. 14331	12	. 85669
3	. 84216	13	. 15784	. 98560	25	. 01440	. 14343	12	. 85657
4	. 84229	13	. 15771	. 98585	25	. 01415	. 14355	12	. 85645
5	9. 84242	13	10. 15758	9. 98610	25	10. 01390	10. 14368	12	9. 85632
6	. 84255	14	. 15745	. 98635	26	. 01365	. 14380	12	. 85620
7	. 84269	13	. 15731	. 98661	25	. 01339	. 14392	12	. 85608
8	. 84282	13	. 15718	. 98686	25	. 01314	. 14404	12	. 85596
9	. 84295	13	. 15705	. 98711	26	. 01289	. 14417	13	. 85583
10	9. 84308	13	10. 15692	9. 98737	25	10. 01263	10. 14429	12	9. 85571
11	. 84321	13	. 15679	. 98762	25	. 01238	. 14441	12	. 85559
12	. 84334	13	. 15666	. 98787	25	. 01213	. 14453	13	. 85547
13	. 84347	13	. 15653	. 98812	26	. 01188	. 14466	12	. 85534
14	. 84360	13	. 15640	. 98838	25	. 01162	. 14478	12	. 85522
15	9. 84373	12	10. 15627	9. 98863	25	10. 01137	10. 14490	13	9. 85510
16	. 84385	13	. 15615	. 98888	25	. 01112	. 14503	12	. 85497
17	. 84398	13	. 15602	. 98913	26	. 01087	. 14515	12	. 85485
18	. 84411	13	. 15589	. 98939	25	. 01061	. 14527	13	. 85473
19	. 84424	13	. 15576	. 98964	25	. 01036	. 14540	12	. 85460
20	9. 84437	13	10. 15563	9. 98989	26	10. 01011	10. 14552	12	9. 85448
21	. 84450	13	. 15550	. 99015	25	. 00985	. 14564	13	. 85436
22	. 84463	13	. 15537	. 99040	25	. 00960	. 14577	12	. 85423
23	. 84476	13	. 15524	. 99065	25	. 00935	. 14589	12	. 85411
24	. 84489	13	. 15511	. 99090	26	. 00910	. 14601	13	. 85399
25	9. 84502	13	10. 15498	9. 99116	25	10. 00884	10. 14614	12	9. 85386
26	. 84515	13	. 15485	. 99141	25	. 00859	. 14626	13	. 85374
27	. 84528	12	. 15472	. 99166	25	. 00834	. 14639	12	. 85361
28	. 84540	13	. 15460	. 99191	26	. 00809	. 14651	12	. 85349
29	. 84553	13	. 15447	. 99217	25	. 00783	. 14663	13	. 85337
30	9. 84566	13	10. 15434	9. 99242	25	10. 00758	10. 14676	12	9. 85324
31	. 84579	13	. 15421	. 99267	26	. 00733	. 14688	13	. 85312
32	. 84592	13	. 15408	. 99293	25	. 00707	. 14701	12	. 85299
33	. 84605	13	. 15395	. 99318	25	. 00682	. 14713	13	. 85287
34	. 84618	12	. 15382	. 99343	25	. 00657	. 14726	12	. 85274
35	9. 84630	13	10. 15370	9. 99368	26	10. 00632	10. 14738	12	9. 85262
36	. 84643	13	. 15357	. 99394	25	. 00606	. 14750	13	. 85250
37	. 84656	13	. 15344	. 99419	25	. 00581	. 14763	12	. 85237
38	. 84669	13	. 15331	. 99444	25	. 00556	. 14775	13	. 85225
39	. 84682	12	. 15318	. 99469	26	. 00531	. 14788	12	. 85212
40	9. 84694	13	10. 15306	9. 99495	25	10. 00505	10. 14800	13	9. 85200
41	. 84707	13	. 15293	. 99520	25	. 00480	. 14813	12	. 85187
42	. 84720	13	. 15280	. 99545	25	. 00455	. 14825	13	. 85175
43	. 84733	12	. 15267	. 99570	26	. 00430	. 14838	12	. 85162
44	. 84745	13	. 15255	. 99596	25	. 00404	. 14850	13	. 85150
45	9. 84758	13	10. 15242	9. 99621	25	10. 00379	10. 14863	12	9. 85137
46	. 84771	13	. 15229	. 99646	26	. 00354	. 14875	13	. 85125
47	. 84784	12	. 15216	. 99672	25	. 00328	. 14888	12	. 85112
48	. 84796	13	. 15204	. 99697	25	. 00303	. 14900	13	. 85100
49	. 84809	13	. 15191	. 99722	25	. 00278	. 14913	13	. 85087
50	9. 84822	13	10. 15178	9. 99747	26	10. 00253	10. 14926	12	9. 85074
51	. 84835	12	. 15165	. 99773	25	. 00227	. 14938	13	. 85062
52	. 84847	13	. 15153	. 99798	25	. 00202	. 14951	12	. 85049
53	. 84860	13	. 15140	. 99823	25	. 00177	. 14963	13	. 85037
54	. 84873	12	. 15127	. 99848	26	. 00152	. 14976	12	. 85024
55	9. 84885	13	10. 15115	9. 99874	25	10. 00126	10. 14988	13	9. 85012
56	. 84898	13	. 15102	. 99899	25	. 00101	. 15001	13	. 84999
57	. 84911	12	. 15089	. 99924	25	. 00076	. 15014	12	. 84986
58	. 84923	13	. 15077	. 99949	26	. 00051	. 15026	13	. 84974
59	. 84936	13	. 15064	. 99975	25	. 00025	. 15039	12	. 84961
60	9. 84949	13	10. 15051	10. 00000	25	10. 00000	10. 15051	12	9. 84949
↑134°→	cos	Diff. 1'	sec	cot	Diff. 1'	tan	csc	Diff. 1'	sin ↑45°

Haversines

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	0°		1°		2°		3°		4°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	Inf. Neg.	0. 00000	5. 88168	0. 00008	6. 48371	0. 00030	6. 83584	0. 00069	7. 08564	0. 00122	60
1	2. 32539	. 00000	. 89604	. 00008	. 49092	. 00031	. 84065	. 00069	. 08925	. 00123	59
2	2. 92745	. 00000	. 91016	. 00008	. 49807	. 00031	. 84543	. 00070	. 09284	. 00124	58
3	3. 27963	. 00000	. 92406	. 00008	. 50516	. 00032	. 85019	. 00071	. 09642	. 00125	57
4	. 52951	. 00000	. 93774	. 00009	. 51219	. 00033	. 85492	. 00072	. 09999	. 00126	56
5	3. 72333	0. 00000	5. 95121	0. 00009	6. 51916	0. 00033	6. 85963	0. 00072	7. 10354	0. 00127	55
6	3. 88169	. 00000	. 96447	. 00009	. 52608	. 00034	. 86431	. 00073	. 10708	. 00128	54
7	4. 01559	. 00000	. 97753	. 00009	. 53295	. 00034	. 86897	. 00074	. 11060	. 00129	53
8	. 13157	. 00000	5. 99040	. 00010	. 53976	. 00035	. 87360	. 00075	. 11411	. 00130	52
9	. 23388	. 00000	6. 00308	. 00010	. 54652	. 00035	. 87821	. 00076	. 11760	. 00131	51
10	4. 32539	0. 00000	6. 01557	0. 00010	6. 55323	0. 00036	6. 88279	0. 00076	7. 12108	0. 00132	50
11	. 40818	. 00000	. 02789	. 00011	. 55988	. 00036	. 88735	. 00077	. 12455	. 00133	49
12	. 48375	. 00000	. 04004	. 00011	. 56649	. 00037	. 89188	. 00078	. 12800	. 00134	48
13	. 55328	. 00000	. 05202	. 00011	. 57304	. 00037	. 89639	. 00079	. 13144	. 00135	47
14	. 61765	. 00000	. 06384	. 00012	. 57955	. 00038	. 90088	. 00080	. 13486	. 00136	46
15	4. 67757	0. 00000	6. 07550	0. 00012	6. 58600	0. 00039	6. 90535	0. 00080	7. 13827	0. 00137	45
16	. 73363	. 00001	. 08700	. 00012	. 59241	. 00039	. 90979	. 00081	. 14167	. 00139	44
17	. 78629	. 00001	. 09836	. 00013	. 59878	. 00040	. 91421	. 00082	. 14506	. 00140	43
18	. 83594	. 00001	. 10956	. 00013	. 60509	. 00040	. 91860	. 00083	. 14843	. 00141	42
19	. 88290	. 00001	. 12063	. 00013	. 61136	. 00041	. 92298	. 00084	. 15179	. 00142	41
20	4. 92745	0. 00001	6. 13155	0. 00014	6. 61759	0. 00041	6. 92733	0. 00085	7. 15513	0. 00143	40
21	4. 96983	. 00001	. 14234	. 00014	. 62377	. 00042	. 93166	. 00085	. 15846	. 00144	39
22	5. 01024	. 00001	. 15300	. 00014	. 62991	. 00043	. 93597	. 00086	. 16178	. 00145	38
23	. 04885	. 00001	. 16353	. 00015	. 63600	. 00043	. 94026	. 00087	. 16509	. 00146	37
24	. 08581	. 00001	. 17393	. 00015	. 64205	. 00044	. 94453	. 00088	. 16839	. 00147	36
25	5. 12127	0. 00001	6. 18421	0. 00015	6. 64806	0. 00044	6. 94877	0. 00089	7. 17167	0. 00148	35
26	. 15534	. 00001	. 19437	. 00016	. 65403	. 00045	. 95300	. 00090	. 17494	. 00150	34
27	. 18812	. 00002	. 20441	. 00016	. 65996	. 00046	. 95720	. 00091	. 17820	. 00151	33
28	. 21971	. 00002	. 21433	. 00016	. 66585	. 00046	. 96139	. 00091	. 18144	. 00152	32
29	. 25019	. 00002	. 22415	. 00017	. 67170	. 00047	. 96555	. 00092	. 18468	. 00153	31
30	5. 27963	0. 00002	6. 23385	0. 00017	6. 67751	0. 00048	6. 96970	0. 00093	7. 18740	0. 00154	30
31	. 30811	. 00002	. 24345	. 00018	. 68328	. 00048	. 97382	. 00094	. 19011	. 00155	29
32	. 33569	. 00002	. 25294	. 00018	. 68901	. 00049	. 97793	. 00095	. 19330	. 00156	28
33	. 36242	. 00002	. 26233	. 00018	. 69470	. 00050	. 98201	. 00096	. 19649	. 00158	27
34	. 38835	. 00002	. 27162	. 00019	. 70036	. 00050	. 98608	. 00097	. 20066	. 00159	26
35	5. 41352	0. 00003	6. 28081	0. 00019	6. 70598	0. 00051	6. 99013	0. 00098	7. 20383	0. 00160	25
36	. 43799	. 00003	. 28991	. 00019	. 71157	. 00051	. 99416	. 00099	. 20698	. 00161	24
37	. 46179	. 00003	. 29891	. 00020	. 71712	. 00052	. 99817	. 00100	. 21012	. 00162	23
38	. 48496	. 00003	. 30781	. 00020	. 72263	. 00053	. 00216	. 00100	. 21325	. 00163	22
39	. 50752	. 00003	. 31663	. 00021	. 72811	. 00053	. 00613	. 00101	. 21636	. 00165	21
40	5. 52951	0. 00003	6. 32536	0. 00021	6. 73355	0. 00054	7. 01009	0. 00102	7. 21947	0. 00166	20
41	. 55095	. 00004	. 33400	. 00022	. 73896	. 00055	. 01403	. 00103	. 22256	. 00167	19
42	. 57189	. 00004	. 34256	. 00022	. 74434	. 00056	. 01795	. 00104	. 22565	. 00168	18
43	. 59232	. 00004	. 35103	. 00022	. 74969	. 00056	. 02185	. 00105	. 22872	. 00169	17
44	. 61229	. 00004	. 35943	. 00023	. 75500	. 00057	. 02573	. 00106	. 23178	. 00171	16
45	5. 63181	0. 00004	6. 36774	0. 00023	6. 76028	0. 00058	7. 02960	0. 00107	7. 23483	0. 00172	15
46	. 65090	. 00004	. 37597	. 00024	. 76552	. 00058	. 03345	. 00108	. 23787	. 00173	14
47	. 66958	. 00005	. 38412	. 00024	. 77074	. 00059	. 03729	. 00109	. 24090	. 00174	13
48	. 68787	. 00005	. 39220	. 00025	. 77592	. 00060	. 04110	. 00110	. 24392	. 00175	12
49	. 70578	. 00005	. 40021	. 00025	. 78108	. 00060	. 04490	. 00111	. 24693	. 00177	11
50	5. 72332	0. 00005	6. 40814	0. 00026	6. 78620	0. 00061	7. 04869	0. 00112	7. 24993	0. 00178	10
51	. 74052	. 00006	. 41600	. 00026	. 79129	. 00062	. 05245	. 00113	. 25292	. 00179	9
52	. 75739	. 00006	. 42379	. 00027	. 79636	. 00063	. 05620	. 00114	. 25590	. 00180	8
53	. 77394	. 00006	. 43151	. 00027	. 80139	. 00063	. 05994	. 00115	. 25886	. 00181	7
54	. 79017	. 00006	. 43916	. 00027	. 80640	. 00064	. 06366	. 00116	. 26182	. 00183	6
55	5. 80611	0. 00006	6. 44675	0. 00028	6. 81137	0. 00065	7. 06736	0. 00117	7. 26477	0. 00184	5
56	. 82176	. 00007	. 45427	. 00028	. 81632	. 00066	. 07105	. 00118	. 26771	. 00185	4
57	. 83713	. 00007	. 46172	. 00029	. 82121	. 00066	. 07472	. 00119	. 27064	. 00186	3
58	. 85224	. 00007	. 46911	. 00029	. 82614	. 00067	. 07837	. 00120	. 27355	. 00188	2
59	. 86709	. 00007	. 47644	. 00030	. 83100	. 00068	. 08201	. 00121	. 27646	. 00189	1
60	5. 88168	0. 00008	6. 48371	0. 00030	6. 83584	0. 00069	7. 08564	0. 00122	7. 27936	0. 00190	0
	359°		358°		357°		356°		355°		

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Haversines

	5°		6°		7°		8°		9°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	7. 27936	0. 00190	7. 43760	0. 00274	7. 57135	0. 00373	7. 68717	0. 00487	7. 78929	0. 00616	60
1	. 28225	. 00192	. 44001	. 00275	. 57341	. 00374	. 68897	. 00489	. 79089	. 00618	59
2	. 28513	. 00193	. 44241	. 00277	. 57547	. 00376	. 69077	. 00491	. 79249	. 00620	58
3	. 28800	. 00194	. 44480	. 00278	. 57752	. 00378	. 69257	. 00493	. 79409	. 00622	57
4	. 29086	. 00195	. 44719	. 00280	. 57957	. 00380	. 69437	. 00495	. 79568	. 00625	56
5	7. 29371	0. 00197	7. 44957	0. 00282	7. 58162	0. 00382	7. 69616	0. 00497	7. 79728	0. 00627	55
6	. 29655	. 00198	. 45194	. 00283	. 58366	. 00383	. 69794	. 00499	. 79886	. 00629	54
7	. 29938	. 00199	. 45431	. 00285	. 58569	. 00385	. 69972	. 00501	. 80045	. 00632	53
8	. 30220	. 00201	. 45667	. 00286	. 58772	. 00387	. 70150	. 00503	. 80203	. 00634	52
9	. 30502	. 00202	. 45903	. 00288	. 58974	. 00389	. 70328	. 00505	. 80361	. 00636	51
10	7. 30782	0. 00203	7. 46138	0. 00289	7. 59176	0. 00391	7. 70505	0. 00507	7. 80519	0. 00639	50
11	. 31062	. 00204	. 46372	. 00291	. 59378	. 00392	. 70682	. 00509	. 80677	. 00641	49
12	. 31340	. 00206	. 46605	. 00292	. 59579	. 00394	. 70858	. 00511	. 80834	. 00643	48
13	. 31618	. 00207	. 46838	. 00294	. 59779	. 00396	. 71034	. 00513	. 80991	. 00646	47
14	. 31895	. 00208	. 47071	. 00296	. 59979	. 00398	. 71210	. 00515	. 81147	. 00648	46
15	7. 32171	0. 00210	7. 47302	0. 00297	7. 60179	0. 00400	7. 71385	0. 00517	7. 81303	0. 00650	45
16	. 32446	. 00211	. 47533	. 00299	. 60378	. 00402	. 71560	. 00520	. 81459	. 00653	44
17	. 32720	. 00212	. 47764	. 00300	. 60577	. 00403	. 71735	. 00522	. 81615	. 00655	43
18	. 32994	. 00214	. 47994	. 00302	. 60775	. 00405	. 71909	. 00524	. 81771	. 00657	42
19	. 33266	. 00215	. 48223	. 00304	. 60973	. 00407	. 72083	. 00526	. 81926	. 00660	41
20	7. 33538	0. 00216	7. 48452	0. 00305	7. 61170	0. 00409	7. 72257	0. 00528	7. 82081	0. 00662	40
21	. 33809	. 00218	. 48680	. 00307	. 61367	. 00411	. 72430	. 00530	. 82235	. 00664	39
22	. 34079	. 00219	. 48907	. 00308	. 61564	. 00413	. 72603	. 00532	. 82390	. 00667	38
23	. 34348	. 00221	. 49134	. 00310	. 61760	. 00415	. 72775	. 00534	. 82544	. 00669	37
24	. 34616	. 00222	. 49360	. 00312	. 61955	. 00416	. 72948	. 00536	. 82698	. 00671	36
25	7. 34884	0. 00223	7. 49586	0. 00313	7. 62151	0. 00418	7. 73119	0. 00539	7. 82851	0. 00674	35
26	. 35150	. 00225	. 49811	. 00315	. 62345	. 00420	. 73291	. 00541	. 83004	. 00676	34
27	. 35416	. 00226	. 50036	. 00316	. 62540	. 00422	. 73462	. 00543	. 83157	. 00679	33
28	. 35681	. 00227	. 50259	. 00318	. 62733	. 00424	. 73633	. 00545	. 83310	. 00681	32
29	. 35945	. 00229	. 50483	. 00320	. 62927	. 00426	. 73803	. 00547	. 83463	. 00683	31
30	7. 36209	0. 00230	7. 50706	0. 00321	7. 63120	0. 00428	7. 73974	0. 00549	7. 83615	0. 00686	30
31	. 36471	. 00232	. 50928	. 00323	. 63312	. 00430	. 74143	. 00551	. 83767	. 00688	29
32	. 36733	. 00233	. 51149	. 00325	. 63504	. 00432	. 74313	. 00554	. 83918	. 00691	28
33	. 36994	. 00234	. 51370	. 00326	. 63696	. 00433	. 74482	. 00556	. 84070	. 00693	27
34	. 37254	. 00236	. 51591	. 00328	. 63887	. 00435	. 74651	. 00558	. 84221	. 00695	26
35	7. 37514	0. 00237	7. 51811	0. 00330	7. 64078	0. 00437	7. 74819	0. 00560	7. 84372	0. 00698	25
36	. 37773	. 00239	. 52030	. 00331	. 64269	. 00439	. 74988	. 00562	. 84522	. 00700	24
37	. 38030	. 00240	. 52249	. 00333	. 64458	. 00441	. 75155	. 00564	. 84672	. 00703	23
38	. 38288	. 00241	. 52467	. 00335	. 64648	. 00443	. 75323	. 00567	. 84822	. 00705	22
39	. 38544	. 00243	. 52685	. 00336	. 64837	. 00445	. 75490	. 00569	. 84972	. 00707	21
40	7. 38800	0. 00244	7. 52902	0. 00338	7. 65026	0. 00447	7. 75657	0. 00571	7. 85122	0. 00710	20
41	. 39054	. 00246	. 53119	. 00340	. 65214	. 00449	. 75824	. 00573	. 85271	. 00712	19
42	. 39309	. 00247	. 53335	. 00341	. 65402	. 00451	. 75990	. 00575	. 85420	. 00715	18
43	. 39562	. 00249	. 53550	. 00343	. 65590	. 00453	. 76156	. 00578	. 85569	. 00717	17
44	. 39815	. 00250	. 53766	. 00345	. 65777	. 00455	. 76321	. 00580	. 85717	. 00720	16
45	7. 40067	0. 00252	7. 53980	0. 00347	7. 65964	0. 00457	7. 76487	0. 00582	7. 85866	0. 00722	15
46	. 40318	. 00253	. 54194	. 00348	. 66150	. 00459	. 76652	. 00584	. 86014	. 00725	14
47	. 40568	. 00255	. 54407	. 00350	. 66336	. 00461	. 76816	. 00586	. 86161	. 00727	13
48	. 40818	. 00256	. 54620	. 00352	. 66521	. 00463	. 76981	. 00589	. 86309	. 00730	12
49	. 41067	. 00257	. 54833	. 00353	. 66706	. 00465	. 77145	. 00591	. 86456	. 00732	11
50	7. 41315	0. 00259	7. 55045	0. 00355	7. 66891	0. 00467	7. 77308	0. 00593	7. 86603	0. 00735	10
51	. 41563	. 00260	. 55256	. 00357	. 67075	. 00469	. 77472	. 00595	. 86750	. 00737	9
52	. 41810	. 00262	. 55467	. 00359	. 67259	. 00471	. 77635	. 00598	. 86896	. 00740	8
53	. 42056	. 00263	. 55677	. 00360	. 67443	. 00473	. 77798	. 00600	. 87042	. 00742	7
54	. 42301	. 00265	. 55887	. 00362	. 67626	. 00475	. 77960	. 00602	. 87188	. 00745	6
55	7. 42546	0. 00266	7. 56096	0. 00364	7. 67809	0. 00477	7. 78122	0. 00604	7. 87334	0. 00747	5
56	. 42790	. 00268	. 56305	. 00366	. 67991	. 00479	. 78284	. 00607	. 87480	. 00750	4
57	. 43034	. 00269	. 56513	. 00367	. 68173	. 00481	. 78446	. 00609	. 87625	. 00752	3
58	. 43277	. 00271	. 56721	. 00369	. 68355	. 00483	. 78607	. 00611	. 87770	. 00755	2
59	. 43519	. 00272	. 56928	. 00371	. 68536	. 00485	. 78768	. 00613	. 87915	. 00757	1
60	7. 43760	0. 00274	7. 57135	0. 00373	7. 68717	0. 00487	7. 78929	0. 00616	7. 88059	0. 00760	0
	354°		353°		352°		351°		350°		

Haversines

	10°		11°		12°		13°		14°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	7.88059	0.00760	7.96315	0.00919	8.03847	0.01093	8.10772	0.01281	8.17179	0.01485	60
1	.88203	.00762	.96446	.00921	.03967	.01096	.10883	.01285	.17282	.01489	59
2	.88348	.00765	.96577	.00924	.04087	.01099	.10993	.01288	.17384	.01492	58
3	.88491	.00767	.96707	.00927	.04207	.01102	.11104	.01291	.17487	.01496	57
4	.88635	.00770	.96838	.00930	.04326	.01105	.11214	.01295	.17590	.01499	56
5	7.88778	0.00772	7.96968	0.00933	8.04446	0.01108	8.11324	0.01298	8.17692	0.01503	55
6	.88921	.00775	.97098	.00935	.04565	.01111	.11435	.01301	.17794	.01506	54
7	.89064	.00777	.97228	.00938	.04684	.01114	.11544	.01305	.17896	.01510	53
8	.89207	.00780	.97358	.00941	.04803	.01117	.11654	.01308	.17998	.01513	52
9	.89349	.00783	.97487	.00944	.04922	.01120	.11764	.01311	.18100	.01517	51
10	7.89491	0.00785	7.97617	0.00947	8.05041	0.01123	8.11873	0.01314	8.18202	0.01521	50
11	.89633	.00788	.97746	.00949	.05159	.01126	.11983	.01318	.18303	.01524	49
12	.89775	.00790	.97875	.00952	.05277	.01129	.12092	.01321	.18405	.01528	48
13	.89916	.00793	.98003	.00955	.05395	.01132	.12201	.01324	.18506	.01531	47
14	.90057	.00795	.98132	.00958	.05513	.01135	.12310	.01328	.18607	.01535	46
15	7.90198	0.00798	7.98260	0.00961	8.05631	0.01138	8.12419	0.01331	8.18709	0.01538	45
16	.90339	.00801	.98389	.00964	.05749	.01142	.12528	.01334	.18810	.01542	44
17	.90480	.00803	.98517	.00966	.05866	.01145	.12636	.01338	.18910	.01546	43
18	.90620	.00806	.98644	.00969	.05984	.01148	.12745	.01341	.19011	.01549	42
19	.90760	.00808	.98772	.00972	.06101	.01151	.12853	.01344	.19112	.01553	41
20	7.90900	0.00811	7.98899	0.00975	8.06218	0.01154	8.12961	0.01348	8.19212	0.01556	40
21	.91039	.00814	.99027	.00978	.06335	.01157	.13069	.01351	.19313	.01560	39
22	.91179	.00816	.99154	.00981	.06451	.01160	.13177	.01354	.19413	.01564	38
23	.91318	.00819	.99281	.00984	.06568	.01163	.13285	.01358	.19513	.01567	37
24	.91457	.00821	.99407	.00986	.06684	.01166	.13392	.01361	.19613	.01571	36
25	7.91596	0.00824	7.99534	0.00989	8.06800	0.01170	8.13500	0.01365	8.19713	0.01574	35
26	.91734	.00827	.99660	.00992	.06917	.01173	.13607	.01368	.19813	.01578	34
27	.91872	.00829	.99786	.00995	.07032	.01176	.13714	.01371	.19913	.01582	33
28	.92010	.00832	.99912	.00998	.07148	.01179	.13822	.01375	.20012	.01585	32
29	.92148	.00835	8.00038	.01001	.07264	.01182	.13928	.01378	.20112	.01589	31
30	7.92286	0.00837	8.00163	0.01004	8.07379	0.01185	8.14035	0.01382	8.20211	0.01593	30
31	.92423	.00840	.00289	.01007	.07494	.01188	.14142	.01385	.20310	.01596	29
32	.92560	.00843	.00414	.01010	.07610	.01192	.14248	.01388	.20410	.01600	28
33	.92697	.00845	.00539	.01012	.07725	.01195	.14355	.01392	.20509	.01604	27
34	.92834	.00848	.00664	.01015	.07839	.01198	.14461	.01395	.20608	.01607	26
35	7.92970	0.00851	8.00788	0.01018	8.07954	0.01201	8.14567	0.01399	8.20706	0.01611	25
36	.93107	.00853	.00913	.01021	.08069	.01204	.14673	.01402	.20805	.01615	24
37	.93243	.00856	.01037	.01024	.08183	.01207	.14779	.01405	.20904	.01618	23
38	.93379	.00859	.01161	.01027	.08297	.01211	.14885	.01409	.21002	.01622	22
39	.93514	.00861	.01285	.01030	.08411	.01214	.14991	.01412	.21100	.01626	21
40	7.93650	0.00864	8.01409	0.01033	8.08525	0.01217	8.15096	0.01416	8.21199	0.01629	20
41	.93785	.00867	.01532	.01036	.08639	.01220	.15201	.01419	.21297	.01633	19
42	.93920	.00869	.01656	.01039	.08752	.01223	.15307	.01423	.21395	.01637	18
43	.94055	.00872	.01779	.01042	.08866	.01226	.15412	.01426	.21493	.01640	17
44	.94189	.00875	.01902	.01045	.08979	.01230	.15517	.01429	.21590	.01644	16
45	7.94324	0.00877	8.02025	0.01048	8.09092	0.01233	8.15622	0.01433	8.21688	0.01648	15
46	.94458	.00880	.02148	.01051	.09205	.01236	.15726	.01436	.21785	.01651	14
47	.94592	.00883	.02270	.01054	.09318	.01239	.15831	.01440	.21883	.01655	13
48	.94726	.00886	.02392	.01057	.09431	.01243	.15935	.01443	.21980	.01659	12
49	.94859	.00888	.02515	.01060	.09543	.01246	.16040	.01447	.22077	.01663	11
50	7.94992	0.00891	8.02637	0.01063	8.09656	0.01249	8.16144	0.01450	8.22175	0.01666	10
51	.95126	.00894	.02758	.01066	.09768	.01252	.16248	.01454	.22272	.01670	9
52	.95259	.00897	.02880	.01069	.09880	.01255	.16352	.01457	.22368	.01674	8
53	.95391	.00899	.03001	.01072	.09992	.01259	.16456	.01461	.22465	.01677	7
54	.95524	.00902	.03123	.01075	.10104	.01262	.16559	.01464	.22562	.01681	6
55	7.95656	0.00905	8.03244	0.01078	8.10216	0.01265	8.16663	0.01468	8.22658	0.01685	5
56	.95788	.00908	.03365	.01081	.10327	.01268	.16766	.01471	.22755	.01689	4
57	.95920	.00910	.03486	.01084	.10439	.01272	.16870	.01475	.22851	.01692	3
58	.96052	.00913	.03606	.01087	.10550	.01275	.16973	.01478	.22947	.01696	2
59	.96183	.00916	.03727	.01090	.10661	.01278	.17076	.01482	.23044	.01700	1
60	7.96315	0.00919	8.03847	0.01093	8.10772	0.01281	8.17179	0.01485	8.23140	0.01704	0
	349°		348°		347°		346°		345°		

2

Haversines

	15°		16°		17°		18°		19°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	8.23140	0.01704	8.28711	0.01937	8.33940	0.02185	8.38867	0.02447	8.43522	0.02724	60
1	23235	0.01707	28801	0.01941	34025	0.02189	38946	0.02452	43597	0.02729	59
2	23331	0.01711	28891	0.01945	34109	0.02193	39026	0.02456	43673	0.02734	58
3	23427	0.01715	28980	0.01949	34194	0.02198	39105	0.02461	43748	0.02738	57
4	23523	0.01719	29070	0.01953	34278	0.02202	39185	0.02465	43823	0.02743	56
5	8.23618	0.01723	8.29159	0.01957	8.34362	0.02206	8.39264	0.02470	8.43990	0.02748	55
6	23713	0.01726	29249	0.01961	34446	0.02210	39344	0.02474	43974	0.02753	54
7	23809	0.01730	29338	0.01965	34539	0.02215	39423	0.02479	44049	0.02757	53
8	23904	0.01734	29427	0.01969	34614	0.02219	39502	0.02483	44124	0.02762	52
9	23999	0.01738	29516	0.01973	34698	0.02223	39581	0.02488	44199	0.02767	51
10	8.24094	0.01742	8.29605	0.01977	8.34782	0.02227	8.39660	0.02492	8.44273	0.02772	50
11	24189	0.01745	29694	0.01981	34865	0.02232	39739	0.02497	44348	0.02776	49
12	24283	0.01749	29783	0.01985	34949	0.02236	39818	0.02501	44423	0.02781	48
13	24378	0.01753	29872	0.01989	35032	0.02240	39897	0.02506	44498	0.02786	47
14	24473	0.01757	29960	0.01993	35116	0.02245	39976	0.02510	44572	0.02791	46
15	8.24567	0.01761	8.30049	0.01998	8.35199	0.02249	8.40055	0.02515	8.44647	0.02796	45
16	24661	0.01764	30137	0.02002	35282	0.02253	40133	0.02519	44721	0.02800	44
17	24755	0.01768	30226	0.02006	35365	0.02258	40212	0.02524	44796	0.02805	43
18	24850	0.01772	30314	0.02010	35449	0.02262	40290	0.02529	44870	0.02810	42
19	24944	0.01776	30402	0.02014	35532	0.02266	40369	0.02533	44944	0.02815	41
20	8.25037	0.01780	8.30490	0.02018	8.35614	0.02271	8.40447	0.02538	8.45018	0.02820	40
21	25131	0.01784	30578	0.02022	35697	0.02275	40525	0.02542	45093	0.02824	39
22	25225	0.01788	30666	0.02026	35780	0.02279	40603	0.02547	45167	0.02829	38
23	25319	0.01791	30754	0.02030	35863	0.02284	40681	0.02552	45241	0.02834	37
24	25412	0.01795	30842	0.02034	35945	0.02288	40760	0.02556	45315	0.02839	36
25	8.25505	0.01799	8.30929	0.02038	8.36028	0.02292	8.40837	0.02561	8.45388	0.02844	35
26	25599	0.01803	31017	0.02043	36110	0.02297	40915	0.02565	45462	0.02849	34
27	25692	0.01807	31104	0.02047	36193	0.02301	40993	0.02570	45536	0.02853	33
28	25785	0.01811	31192	0.02051	36275	0.02305	41071	0.02575	45610	0.02858	32
29	25878	0.01815	31279	0.02055	36357	0.02310	41149	0.02579	45683	0.02863	31
30	8.25971	0.01818	8.31366	0.02059	8.36439	0.02314	8.41226	0.02584	8.45757	0.02868	30
31	26064	0.01822	31453	0.02063	36521	0.02319	41304	0.02588	45830	0.02873	29
32	26156	0.01826	31540	0.02067	36603	0.02323	41381	0.02593	45904	0.02878	28
33	26249	0.01830	31627	0.02071	36685	0.02327	41459	0.02598	45977	0.02883	27
34	26341	0.01834	31714	0.02076	36767	0.02332	41536	0.02602	46050	0.02887	26
35	8.26434	0.01838	8.31800	0.02080	8.36849	0.02336	8.41613	0.02607	8.46121	0.02892	25
36	26526	0.01842	31887	0.02084	36930	0.02340	41690	0.02612	46197	0.02897	24
37	26618	0.01846	31974	0.02088	37012	0.02345	41767	0.02616	46270	0.02902	23
38	26710	0.01850	32060	0.02092	37093	0.02349	41845	0.02621	46343	0.02907	22
39	26802	0.01854	32147	0.02096	37175	0.02354	41921	0.02626	46416	0.02912	21
40	8.26894	0.01858	8.32233	0.02101	8.37256	0.02358	8.41998	0.02630	8.46489	0.02917	20
41	26986	0.01861	32319	0.02105	37337	0.02363	42075	0.02635	46562	0.02922	19
42	27078	0.01865	32405	0.02109	37419	0.02367	42152	0.02639	46634	0.02926	18
43	27169	0.01869	32491	0.02113	37500	0.02371	42229	0.02644	46707	0.02931	17
44	27261	0.01873	32577	0.02117	37581	0.02376	42305	0.02649	46780	0.02936	16
45	8.27352	0.01877	8.32663	0.02121	8.37662	0.02380	8.42382	0.02653	8.46852	0.02941	15
46	27443	0.01881	32749	0.02126	37742	0.02385	42458	0.02658	46925	0.02946	14
47	27534	0.01885	32834	0.02130	37823	0.02389	42535	0.02663	46998	0.02951	13
48	27626	0.01889	32920	0.02134	37904	0.02394	42611	0.02668	47070	0.02956	12
49	27717	0.01893	33006	0.02138	37985	0.02398	42687	0.02672	47142	0.02961	11
50	8.27807	0.01897	8.33091	0.02142	8.38065	0.02402	8.42764	0.02677	8.47215	0.02966	10
51	27898	0.01901	33176	0.02147	38146	0.02407	42840	0.02682	47287	0.02971	9
52	27989	0.01905	33262	0.02151	38226	0.02411	42916	0.02686	47359	0.02976	8
53	28080	0.01909	33347	0.02155	38306	0.02416	42992	0.02691	47431	0.02981	7
54	28170	0.01913	33432	0.02159	38387	0.02420	43068	0.02696	47503	0.02986	6
55	8.28260	0.01917	8.33517	0.02164	8.38467	0.02425	8.43144	0.02700	8.47575	0.02991	5
56	28351	0.01921	33602	0.02168	38547	0.02429	43219	0.02705	47647	0.02996	4
57	28441	0.01925	33686	0.02172	38627	0.02434	43295	0.02710	47719	0.03000	3
58	28531	0.01929	33771	0.02176	38707	0.02438	43371	0.02715	47791	0.03005	2
59	28621	0.01933	33856	0.02181	38787	0.02443	43446	0.02719	47862	0.03010	1
60	8.28711	0.01937	8.33940	0.02185	8.38867	0.02447	8.43522	0.02724	8.47934	0.03015	0

344°

343°

342°

341°

340°

Haversines

2

	20°		21°		22°		23°		24°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	8.47934	0.03015	8.52127	0.03321	8.56120	0.03641	8.59931	0.03975	8.63576	0.04323	60
1	48006	03020	52195	03326	56185	03646	59993	03980	63635	04329	59
2	48077	03025	52263	03331	56250	03652	60055	03986	63695	04335	58
3	48149	03030	52331	03337	56315	03657	60117	03992	63754	04340	57
4	48220	03035	52399	03342	56379	03663	60179	03998	63813	04346	56
5	48292	03040	52467	03347	56444	03668	60241	04003	63872	04352	55
6	48363	03045	52535	03352	56509	03674	60303	04009	63932	04358	54
7	48434	03050	52602	03358	56574	03679	60365	04015	63991	04364	53
8	48505	03055	52670	03363	56638	03685	60426	04020	64050	04370	52
9	48576	03060	52738	03368	56703	03690	60488	04026	64109	04376	51
10	48648	03065	52806	03373	56767	03695	60550	04032	64168	04382	50
11	48719	03070	52873	03379	56832	03701	60611	04038	64227	04388	49
12	48789	03075	52941	03384	56896	03706	60673	04043	64286	04394	48
13	48860	03080	53008	03389	56960	03712	60734	04049	64345	04400	47
14	48931	03085	53076	03394	57025	03717	60796	04055	64404	04406	46
15	49002	03090	53143	03400	57089	03723	60857	04060	64463	04412	45
16	49073	03095	53210	03405	57153	03728	60919	04066	64521	04418	44
17	49143	03101	53277	03410	57217	03734	60980	04072	64580	04424	43
18	49214	03106	53345	03415	57282	03740	61041	04078	64639	04430	42
19	49284	03111	53412	03421	57346	03745	61103	04083	64697	04436	41
20	49355	03116	53479	03426	57410	03751	61164	04089	64756	04442	40
21	49425	03121	53546	03431	57474	03756	61225	04095	64815	04448	39
22	49496	03126	53613	03437	57538	03762	61286	04101	64873	04454	38
23	49566	03131	53680	03442	57601	03767	61347	04106	64932	04460	37
24	49636	03136	53747	03447	57665	03773	61408	04112	64990	04466	36
25	49706	03141	53814	03453	57729	03778	61469	04118	65049	04472	35
26	49777	03146	53880	03458	57793	03784	61530	04124	65107	04478	34
27	49847	03151	53947	03463	57856	03789	61591	04130	65165	04484	33
28	49917	03156	54014	03468	57920	03795	61652	04135	65224	04490	32
29	49987	03161	54080	03474	57984	03800	61713	04141	65282	04496	31
30	50056	03166	54147	03479	58047	03806	61773	04147	65340	04502	30
31	50126	03171	54214	03484	58111	03812	61834	04153	65398	04508	29
32	50196	03177	54280	03490	58174	03817	61895	04159	65456	04514	28
33	50266	03182	54346	03495	58238	03823	61955	04164	65514	04520	27
34	50335	03187	54413	03500	58301	03828	62016	04170	65572	04526	26
35	50405	03192	54479	03506	58364	03834	62077	04176	65630	04532	25
36	50475	03197	54545	03511	58427	03839	62137	04182	65688	04538	24
37	50544	03202	54612	03517	58491	03845	62197	04188	65746	04544	23
38	50614	03207	54678	03522	58554	03851	62258	04194	65804	04550	22
39	50683	03212	54744	03527	58617	03856	62318	04199	65862	04556	21
40	50752	03218	54810	03533	58680	03862	62379	04205	65920	04562	20
41	50821	03223	54876	03538	58743	03867	62439	04211	65978	04569	19
42	50891	03228	54942	03543	58806	03873	62499	04217	66035	04575	18
43	50960	03233	55008	03549	58869	03879	62559	04223	66093	04581	17
44	51029	03238	55073	03554	58932	03884	62619	04229	66151	04587	16
45	51098	03243	55139	03560	58994	03890	62680	04234	66208	04593	15
46	51167	03248	55205	03565	59057	03896	62740	04240	66266	04599	14
47	51236	03254	55271	03570	59120	03901	62800	04246	66323	04605	13
48	51305	03259	55336	03576	59183	03907	62860	04252	66381	04611	12
49	51374	03264	55402	03581	59245	03912	62919	04258	66438	04617	11
50	51442	03269	55467	03587	59308	03918	62979	04264	66496	04623	10
51	51511	03274	55533	03592	59370	03924	63039	04270	66553	04629	9
52	51580	03279	55598	03597	59433	03929	63099	04276	66610	04636	8
53	51648	03285	55664	03603	59495	03935	63159	04281	66668	04642	7
54	51717	03290	55729	03608	59558	03941	63218	04287	66725	04648	6
55	51785	03295	55794	03614	59620	03946	63278	04293	66782	04654	5
56	51854	03300	55859	03619	59682	03952	63338	04299	66839	04660	4
57	51922	03305	55925	03624	59745	03958	63397	04305	66896	04666	3
58	51990	03311	55990	03630	59807	03963	63457	04311	66953	04672	2
59	52058	03316	56055	03635	59869	03969	63516	04317	67010	04678	1
60	8.52127	0.03321	8.56120	0.03641	8.59931	0.03975	8.63576	0.04323	8.67067	0.04685	0
	339°		338°		337°		336°		335°		

2

Haversines

	25°		26°		27°		28°		29°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	8.67067	0.04685	8.70418	0.05060	8.73637	0.05450	8.76735	0.05853	8.79720	0.06269	60
1	67124	.04691	70472	.05067	73690	.05456	76786	.05859	79769	.06276	59
2	67181	.04697	70527	.05073	73742	.05463	76836	.05866	79818	.06283	58
3	67238	.04703	70582	.05079	73795	.05469	76887	.05873	79866	.06290	57
4	67295	.04709	70636	.05086	73847	.05476	76938	.05880	79915	.06297	56
5	8.67352	0.04715	8.70691	0.05092	8.73900	0.05483	8.76988	0.05887	8.79964	0.06304	55
6	67409	.04722	70745	.05099	73952	.05489	77039	.05894	80013	.06311	54
7	67465	.04728	70800	.05105	74005	.05496	77089	.05901	80061	.06318	53
8	67522	.04734	70854	.05111	74057	.05503	77139	.05907	80110	.06326	52
9	67579	.04740	70909	.05118	74109	.05509	77190	.05914	80158	.06333	51
10	8.67635	0.04746	8.70963	0.05124	8.74162	0.05516	8.77240	0.05921	8.80207	0.06340	50
11	67692	.04752	71017	.05131	74214	.05523	77291	.05928	80256	.06347	49
12	67748	.04759	71072	.05137	74266	.05529	77341	.05935	80304	.06354	48
13	67805	.04765	71126	.05144	74318	.05536	77391	.05942	80353	.06361	47
14	67861	.04771	71180	.05150	74371	.05542	77441	.05949	80401	.06368	46
15	8.67918	0.04777	8.71234	0.05156	8.74423	0.05549	8.77492	0.05955	8.80449	0.06375	45
16	67974	.04783	71289	.05163	74475	.05556	77542	.05962	80498	.06382	44
17	68030	.04790	71343	.05169	74527	.05562	77592	.05969	80546	.06389	43
18	68087	.04796	71397	.05176	74579	.05569	77642	.05976	80595	.06397	42
19	68143	.04802	71451	.05182	74631	.05576	77692	.05983	80643	.06404	41
20	8.68199	0.04808	8.71505	0.05189	8.74683	0.05582	8.77742	0.05990	8.80691	0.06411	40
21	68256	.04815	71559	.05195	74735	.05589	77792	.05997	80739	.06418	39
22	68312	.04821	71613	.05201	74787	.05596	77842	.06004	80788	.06425	38
23	68368	.04827	71667	.05208	74839	.05603	77892	.06011	80836	.06432	37
24	68424	.04833	71721	.05214	74890	.05609	77942	.06018	80884	.06439	36
25	8.68480	0.04839	8.71774	0.05221	8.74942	0.05616	8.77992	0.06024	8.80932	0.06446	35
26	68536	.04846	71828	.05227	74994	.05623	78042	.06031	80980	.06454	34
27	68592	.04852	71882	.05234	75046	.05629	78092	.06038	81028	.06461	33
28	68648	.04858	71936	.05240	75097	.05636	78142	.06045	81076	.06468	32
29	68704	.04864	71989	.05247	75149	.05643	78191	.06052	81124	.06475	31
30	8.68760	0.04871	8.72043	0.05253	8.75201	0.05649	8.78241	0.06059	8.81172	0.06482	30
31	68815	.04877	72097	.05260	75252	.05656	78291	.06066	81220	.06489	29
32	68871	.04883	72150	.05266	75304	.05663	78341	.06073	81268	.06497	28
33	68927	.04890	72204	.05273	75355	.05670	78390	.06080	81316	.06504	27
34	68983	.04896	72257	.05279	75407	.05676	78440	.06087	81364	.06511	26
35	8.69038	0.04902	8.72311	0.05286	8.75458	0.05683	8.78490	0.06094	8.81412	0.06518	25
36	69094	.04908	72364	.05292	75510	.05690	78539	.06101	81460	.06525	24
37	69149	.04915	72418	.05299	75561	.05697	78589	.06108	81508	.06532	23
38	69205	.04921	72471	.05305	75613	.05703	78638	.06115	81555	.06540	22
39	69260	.04927	72525	.05312	75664	.05710	78688	.06122	81603	.06547	21
40	8.69316	0.04934	8.72578	0.05318	8.75715	0.05717	8.78737	0.06129	8.81651	0.06554	20
41	69371	.04940	72631	.05325	75767	.05724	78787	.06136	81699	.06561	19
42	69427	.04946	72684	.05331	75818	.05730	78836	.06143	81746	.06568	18
43	69482	.04952	72738	.05338	75869	.05737	78885	.06150	81794	.06576	17
44	69537	.04959	72791	.05345	75920	.05744	78935	.06157	81841	.06583	16
45	8.69593	0.04965	8.72844	0.05351	8.75972	0.05751	8.78984	0.06164	8.81889	0.06590	15
46	69648	.04971	72897	.05358	76023	.05757	79033	.06171	81937	.06597	14
47	69703	.04978	72950	.05364	76074	.05764	79082	.06178	81984	.06605	13
48	69758	.04984	73003	.05371	76125	.05771	79132	.06185	82032	.06612	12
49	69814	.04990	73056	.05377	76176	.05778	79181	.06192	82079	.06619	11
50	8.69869	0.04997	8.73109	0.05384	8.76227	0.05785	8.79230	0.06199	8.82126	0.06626	10
51	69924	.05003	73162	.05390	76278	.05791	79279	.06206	82174	.06633	9
52	69979	.05009	73215	.05397	76329	.05798	79328	.06213	82221	.06641	8
53	70034	.05016	73268	.05404	76380	.05805	79377	.06220	82269	.06648	7
54	70089	.05022	73321	.05410	76431	.05812	79426	.06227	82316	.06655	6
55	8.70144	0.05028	8.73374	0.05417	8.76481	0.05819	8.79475	0.06234	8.82363	0.06662	5
56	70198	.05035	73426	.05423	76532	.05825	79524	.06241	82410	.06670	4
57	70253	.05041	73479	.05430	76583	.05832	79573	.06248	82458	.06677	3
58	70308	.05048	73532	.05436	76634	.05839	79622	.06255	82505	.06684	2
59	70363	.05054	73584	.05443	76684	.05846	79671	.06262	82552	.06691	1
60	8.70418	0.05060	8.73637	0.05450	8.76735	0.05853	8.79720	0.06269	8.82599	0.06699	0
	334°		333°		332°		331°		330°		

Haversines

2

	30°		31°		32°		33°		34°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	8.82599	0.06699	8.85380	0.07142	8.88068	0.07598	8.90668	0.08066	8.93187	0.08548	60
1	8.82646	0.06706	8.85425	0.07149	8.88112	0.07605	8.90711	0.08074	8.93228	0.08556	59
2	8.82694	0.06713	8.85471	0.07157	8.88156	0.07613	8.90754	0.08082	8.93270	0.08564	58
3	8.82741	0.06721	8.85516	0.07164	8.88200	0.07621	8.90796	0.08090	8.93311	0.08573	57
4	8.82788	0.06728	8.85562	0.07172	8.88244	0.07628	8.90839	0.08098	8.93352	0.08581	56
5	8.82835	0.06735	8.85607	0.07179	8.88288	0.07636	8.90881	0.08106	8.93393	0.08589	55
6	8.82882	0.06742	8.85653	0.07187	8.88332	0.07644	8.90924	0.08114	8.93435	0.08597	54
7	8.82929	0.06750	8.85698	0.07194	8.88375	0.07652	8.90966	0.08122	8.93476	0.08605	53
8	8.82976	0.06757	8.85743	0.07202	8.88419	0.07659	8.91009	0.08130	8.93517	0.08613	52
9	8.83023	0.06764	8.85789	0.07209	8.88463	0.07667	8.91051	0.08138	8.93558	0.08621	51
10	8.83069	0.06772	8.85834	0.07217	8.88507	0.07675	8.91094	0.08146	8.93599	0.08630	50
11	8.83116	0.06779	8.85879	0.07224	8.88551	0.07683	8.91136	0.08154	8.93640	0.08638	49
12	8.83163	0.06786	8.85925	0.07232	8.88595	0.07690	8.91179	0.08162	8.93681	0.08646	48
13	8.83210	0.06794	8.85970	0.07239	8.88638	0.07698	8.91221	0.08170	8.93722	0.08654	47
14	8.83257	0.06801	8.86015	0.07247	8.88682	0.07706	8.91263	0.08178	8.93764	0.08662	46
15	8.83303	0.06808	8.86060	0.07254	8.88726	0.07714	8.91306	0.08186	8.93805	0.08671	45
16	8.83350	0.06816	8.86105	0.07262	8.88769	0.07721	8.91348	0.08194	8.93846	0.08679	44
17	8.83397	0.06823	8.86151	0.07270	8.88813	0.07729	8.91390	0.08202	8.93886	0.08687	43
18	8.83444	0.06830	8.86196	0.07277	8.88857	0.07737	8.91432	0.08210	8.93927	0.08695	42
19	8.83490	0.06838	8.86241	0.07285	8.88900	0.07745	8.91475	0.08218	8.93968	0.08703	41
20	8.83537	0.06845	8.86286	0.07292	8.88944	0.07752	8.91517	0.08226	8.94009	0.08711	40
21	8.83583	0.06852	8.86331	0.07300	8.88988	0.07760	8.91559	0.08234	8.94050	0.08720	39
22	8.83630	0.06860	8.86376	0.07307	8.89031	0.07768	8.91601	0.08242	8.94091	0.08728	38
23	8.83676	0.06867	8.86421	0.07315	8.89075	0.07776	8.91643	0.08250	8.94132	0.08736	37
24	8.83723	0.06874	8.86466	0.07322	8.89118	0.07784	8.91685	0.08258	8.94173	0.08744	36
25	8.83769	0.06882	8.86511	0.07330	8.89162	0.07791	8.91728	0.08266	8.94213	0.08753	35
26	8.83816	0.06889	8.86556	0.07338	8.89205	0.07799	8.91770	0.08274	8.94254	0.08761	34
27	8.83862	0.06896	8.86600	0.07345	8.89248	0.07807	8.91812	0.08282	8.94295	0.08769	33
28	8.83909	0.06904	8.86645	0.07353	8.89292	0.07815	8.91854	0.08290	8.94336	0.08777	32
29	8.83955	0.06911	8.86690	0.07360	8.89335	0.07823	8.91896	0.08298	8.94376	0.08785	31
30	8.84002	0.06919	8.86735	0.07368	8.89379	0.07830	8.91938	0.08306	8.94417	0.08794	30
31	8.84048	0.06926	8.86780	0.07376	8.89422	0.07838	8.91980	0.08314	8.94458	0.08802	29
32	8.84094	0.06933	8.86825	0.07383	8.89465	0.07846	8.92022	0.08322	8.94498	0.08810	28
33	8.84140	0.06941	8.86869	0.07391	8.89509	0.07854	8.92064	0.08330	8.94539	0.08818	27
34	8.84187	0.06948	8.86914	0.07398	8.89552	0.07862	8.92105	0.08338	8.94580	0.08827	26
35	8.84233	0.06955	8.86959	0.07406	8.89595	0.07870	8.92147	0.08346	8.94620	0.08835	25
36	8.84279	0.06963	8.87003	0.07414	8.89638	0.07877	8.92189	0.08354	8.94661	0.08843	24
37	8.84325	0.06970	8.87048	0.07421	8.89681	0.07885	8.92231	0.08362	8.94701	0.08851	23
38	8.84371	0.06978	8.87093	0.07429	8.89725	0.07893	8.92273	0.08370	8.94742	0.08860	22
39	8.84417	0.06985	8.87137	0.07437	8.89768	0.07901	8.92315	0.08378	8.94782	0.08868	21
40	8.84464	0.06993	8.87182	0.07444	8.89811	0.07909	8.92356	0.08386	8.94823	0.08876	20
41	8.84510	0.07000	8.87226	0.07452	8.89854	0.07917	8.92398	0.08394	8.94863	0.08885	19
42	8.84556	0.07007	8.87271	0.07459	8.89897	0.07924	8.92440	0.08402	8.94904	0.08893	18
43	8.84602	0.07015	8.87315	0.07467	8.89940	0.07932	8.92482	0.08410	8.94944	0.08901	17
44	8.84648	0.07022	8.87360	0.07475	8.89983	0.07940	8.92523	0.08418	8.94985	0.08909	16
45	8.84694	0.07030	8.87404	0.07482	8.90026	0.07948	8.92565	0.08427	8.95025	0.08918	15
46	8.84740	0.07037	8.87448	0.07490	8.90069	0.07956	8.92607	0.08435	8.95065	0.08926	14
47	8.84785	0.07045	8.87493	0.07498	8.90112	0.07964	8.92648	0.08443	8.95106	0.08934	13
48	8.84831	0.07052	8.87537	0.07505	8.90155	0.07972	8.92690	0.08451	8.95146	0.08943	12
49	8.84877	0.07059	8.87582	0.07513	8.90198	0.07980	8.92731	0.08459	8.95186	0.08951	11
50	8.84923	0.07067	8.87626	0.07521	8.90241	0.07987	8.92773	0.08467	8.95227	0.08959	10
51	8.84969	0.07074	8.87670	0.07528	8.90284	0.07995	8.92814	0.08475	8.95267	0.08967	9
52	8.85015	0.07082	8.87714	0.07536	8.90326	0.08003	8.92856	0.08483	8.95307	0.08976	8
53	8.85060	0.07089	8.87759	0.07544	8.90369	0.08011	8.92897	0.08491	8.95347	0.08984	7
54	8.85106	0.07097	8.87803	0.07551	8.90412	0.08019	8.92939	0.08499	8.95388	0.08992	6
55	8.85152	0.07104	8.87847	0.07559	8.90455	0.08027	8.92980	0.08507	8.95428	0.09001	5
56	8.85197	0.07112	8.87891	0.07567	8.90498	0.08035	8.93022	0.08516	8.95468	0.09009	4
57	8.85243	0.07119	8.87935	0.07574	8.90540	0.08043	8.93063	0.08524	8.95508	0.09017	3
58	8.85289	0.07127	8.87980	0.07582	8.90583	0.08051	8.93104	0.08532	8.95548	0.09026	2
59	8.85334	0.07134	8.88024	0.07590	8.90626	0.08059	8.93146	0.08540	8.95588	0.09034	1
60	8.85380	0.07142	8.88068	0.07598	8.90668	0.08066	8.93187	0.08548	8.95628	0.09042	0
	329°		328°		327°		326°		325°		

2

Haversines

	35°		36°		37°		38°		39°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	8.95628	0.09042	8.97997	0.09549	9.00295	0.10068	9.02528	0.10599	9.04699	0.11143	60
1	.95668	.09051	.98035	.09558	.00333	.10077	.02565	.10608	.04735	.11152	59
2	.95709	.09059	.98074	.09566	.00371	.10086	.02602	.10617	.04770	.11161	58
3	.95749	.09067	.98113	.09575	.00408	.10094	.02638	.10626	.04806	.11170	57
4	.95789	.09076	.98152	.09583	.00446	.10103	.02675	.10635	.04842	.11179	56
5	8.95828	0.09084	8.98191	0.09592	9.00484	0.10112	9.02712	0.10644	9.04877	0.11189	55
6	.95868	.09093	.98229	.09601	.00522	.10121	.02748	.10653	.04913	.11198	54
7	.95908	.09101	.98268	.09609	.00559	.10130	.02785	.10662	.04948	.11207	53
8	.95948	.09109	.98307	.09618	.00597	.10138	.02821	.10671	.04984	.11216	52
9	.95988	.09118	.98346	.09626	.00634	.10147	.02858	.10680	.05019	.11225	51
10	8.96028	0.09126	8.98384	0.09635	9.00672	0.10156	9.02894	0.10689	9.05055	0.11234	50
11	.96068	.09134	.98423	.09643	.00710	.10165	.02931	.10698	.05090	.11243	49
12	.96108	.09143	.98462	.09652	.00747	.10174	.02967	.10707	.05126	.11253	48
13	.96148	.09151	.98500	.09661	.00785	.10182	.03004	.10716	.05161	.11262	47
14	.96187	.09160	.98539	.09669	.00822	.10191	.03040	.10725	.05197	.11271	46
15	8.96227	0.09168	8.98578	0.09678	9.00860	0.10200	9.03077	0.10734	9.05232	0.11280	45
16	.96267	.09176	.98616	.09686	.00897	.10209	.03113	.10743	.05268	.11290	44
17	.96307	.09185	.98655	.09695	.00935	.10218	.03150	.10752	.05303	.11299	43
18	.96346	.09193	.98693	.09704	.00972	.10226	.03186	.10761	.05339	.11308	42
19	.96386	.09202	.98732	.09712	.01009	.10235	.03222	.10770	.05374	.11317	41
20	8.96426	0.09210	8.98770	0.09721	9.01047	0.10244	9.03259	0.10779	9.05409	0.11326	40
21	.96465	.09218	.98809	.09729	.01084	.10253	.03295	.10788	.05445	.11336	39
22	.96505	.09227	.98847	.09738	.01122	.10262	.03331	.10797	.05480	.11345	38
23	.96545	.09235	.98886	.09747	.01159	.10270	.03368	.10806	.05515	.11354	37
24	.96584	.09244	.98924	.09755	.01196	.10279	.03404	.10815	.05551	.11363	36
25	8.96624	0.09252	8.98963	0.09764	9.01234	0.10288	9.03440	0.10824	9.05586	0.11373	35
26	.96663	.09260	.99001	.09773	.01271	.10297	.03476	.10833	.05621	.11382	34
27	.96703	.09269	.99039	.09781	.01308	.10306	.03513	.10842	.05656	.11391	33
28	.96742	.09277	.99078	.09790	.01345	.10315	.03549	.10851	.05692	.11400	32
29	.96782	.09286	.99116	.09799	.01383	.10323	.03585	.10861	.05727	.11410	31
30	8.96821	0.09294	8.99154	0.09807	9.01420	0.10332	9.03621	0.10870	9.05762	0.11419	30
31	.96861	.09303	.99193	.09816	.01457	.10341	.03657	.10879	.05797	.11428	29
32	.96900	.09311	.99231	.09824	.01494	.10350	.03694	.10888	.05832	.11437	28
33	.96940	.09320	.99269	.09833	.01531	.10359	.03730	.10897	.05867	.11447	27
34	.96979	.09328	.99307	.09842	.01569	.10368	.03766	.10906	.05903	.11456	26
35	8.97018	0.09336	8.99346	0.09850	9.01606	0.10377	9.03802	0.10915	9.05938	0.11465	25
36	.97058	.09345	.99384	.09859	.01643	.10386	.03838	.10924	.05973	.11474	24
37	.97097	.09353	.99422	.09868	.01680	.10394	.03874	.10933	.06008	.11483	23
38	.97136	.09362	.99460	.09876	.01717	.10403	.03910	.10942	.06043	.11493	22
39	.97176	.09370	.99498	.09885	.01754	.10412	.03946	.10951	.06078	.11502	21
40	8.97215	0.09379	8.99536	0.09894	9.01791	0.10421	9.03982	0.10960	9.06113	0.11511	20
41	.97254	.09387	.99575	.09903	.01828	.10430	.04018	.10969	.06148	.11521	19
42	.97294	.09396	.99613	.09911	.01865	.10439	.04054	.10978	.06183	.11530	18
43	.97333	.09404	.99651	.09920	.01902	.10448	.04090	.10988	.06218	.11539	17
44	.97372	.09413	.99689	.09929	.01939	.10457	.04126	.10997	.06253	.11549	16
45	8.97411	0.09421	8.99727	0.09937	9.01976	0.10466	9.04162	0.11006	9.06288	0.11558	15
46	.97450	.09430	.99765	.09946	.02013	.10474	.04198	.11015	.06323	.11567	14
47	.97489	.09438	.99803	.09955	.02050	.10483	.04234	.11024	.06358	.11577	13
48	.97529	.09447	.99841	.09963	.02087	.10492	.04270	.11033	.06393	.11586	12
49	.97568	.09455	.99879	.09972	.02124	.10501	.04306	.11042	.06428	.11595	11
50	8.97607	0.09464	8.99917	0.09981	9.02161	0.10510	9.04341	0.11051	9.06462	0.11604	10
51	.97646	.09472	.99955	.09990	.02197	.10519	.04377	.11060	.06497	.11614	9
52	.97685	.09481	.99993	.09998	.02234	.10528	.04413	.11070	.06532	.11623	8
53	.97724	.09489	9.00031	1.0007	.02271	.10537	.04449	.11079	.06567	.11632	7
54	.97763	.09498	.00068	1.0016	.02308	.10546	.04485	.11088	.06602	.11642	6
55	8.97802	0.09506	9.00106	0.10025	9.02345	0.10555	9.04520	0.11097	9.06637	0.11651	5
56	.97841	.09515	.00144	1.0033	.02381	.10564	.04556	.11106	.06671	.11660	4
57	.97880	.09524	.00182	1.0042	.02418	.10573	.04592	.11115	.06706	.11670	3
58	.97919	.09532	.00220	1.0051	.02455	.10582	.04628	.11124	.06741	.11679	2
59	.97958	.09541	.00258	1.0059	.02492	.10591	.04663	.11134	.06776	.11688	1
60	8.97997	0.09549	9.00295	0.10068	9.02528	0.10599	9.04699	0.11143	9.06810	0.11698	0
	324°		323°		322°		321°		320°		

Haversines

	40°		41°		42°		43°		44°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.06810	0.11698	9.08865	0.12265	9.10866	0.12843	9.12815	0.13432	9.14715	0.14033	60
1	06845	11707	08899	12274	10899	12852	12847	13442	14746	14043	59
2	06880	11716	08933	12284	10932	12862	12879	13452	14778	14053	58
3	06914	11726	08966	12293	10965	12872	12911	13462	14809	14063	57
4	06949	11735	09000	12303	10997	12882	12943	13472	14840	14073	56
5	9.06984	0.11745	9.09034	0.12312	9.11030	0.12891	9.12975	0.13482	9.14871	0.14084	55
6	07018	11754	09068	12322	11063	12901	13007	13492	14902	14094	54
7	07053	11763	09101	12331	11096	12911	13039	13502	14934	14104	53
8	07088	11773	09135	12341	11129	12921	13071	13512	14965	14114	52
9	07122	11782	09169	12351	11161	12930	13103	13522	14996	14124	51
10	9.07157	0.11791	9.09202	0.12360	9.11194	0.12940	9.13135	0.13532	9.15027	0.14134	50
11	07191	11801	09236	12370	11227	12950	13167	13542	15058	14144	49
12	07226	11810	09269	12379	11260	12960	13199	13552	15089	14154	48
13	07260	11820	09303	12389	11292	12970	13231	13562	15120	14165	47
14	07295	11829	09337	12398	11325	12979	13263	13571	15152	14175	46
15	9.07329	0.11838	9.09370	0.12408	9.11358	0.12989	9.13295	0.13581	9.15183	0.14185	45
16	07364	11848	09404	12418	11391	12999	13326	13591	15214	14195	44
17	07398	11857	09437	12427	11423	13009	13358	13601	15245	14205	43
18	07433	11867	09471	12437	11456	13018	13390	13611	15276	14215	42
19	07467	11876	09504	12446	11489	13028	13422	13621	15307	14226	41
20	9.07501	0.11885	9.09538	0.12456	9.11521	0.13038	9.13454	0.13631	9.15338	0.14236	40
21	07536	11895	09571	12466	11554	13048	13486	13641	15369	14246	39
22	07570	11904	09605	12475	11586	13058	13517	13651	15400	14256	38
23	07605	11914	09638	12485	11619	13067	13549	13661	15431	14266	37
24	07639	11923	09672	12494	11652	13077	13581	13671	15462	14276	36
25	9.07673	0.11933	9.09705	0.12504	9.11684	0.13087	9.13613	0.13681	9.15493	0.14287	35
26	07708	11942	09739	12514	11717	13097	13644	13691	15524	14297	34
27	07742	11951	09772	12523	11749	13107	13676	13701	15555	14307	33
28	07776	11961	09805	12533	11782	13116	13708	13711	15585	14317	32
29	07810	11970	09839	12543	11814	13126	13739	13721	15616	14327	31
30	9.07845	0.11980	9.09872	0.12552	9.11847	0.13136	9.13771	0.13731	9.15647	0.14337	30
31	07879	11989	09905	12562	11879	13146	13803	13741	15678	14348	29
32	07913	11999	09939	12571	11912	13156	13834	13751	15709	14358	28
33	07947	12008	09972	12581	11944	13166	13866	13761	15740	14368	27
34	07981	12018	10005	12591	11977	13175	13898	13771	15771	14378	26
35	9.08016	0.12027	9.10039	0.12600	9.12009	0.13185	9.13929	0.13781	9.15802	0.14388	25
36	08050	12036	10072	12610	12041	13195	13961	13791	15832	14399	24
37	08084	12046	10105	12620	12074	13205	13992	13801	15863	14409	23
38	08118	12055	10138	12629	12106	13215	14024	13811	15894	14419	22
39	08152	12065	10172	12639	12139	13225	14056	13822	15925	14429	21
40	9.08186	0.12074	9.10205	0.12649	9.12171	0.13235	9.14087	0.13832	9.15955	0.14440	20
41	08220	12084	10238	12658	12203	13244	14119	13842	15986	14450	19
42	08254	12093	10271	12668	12236	13254	14150	13852	16017	14460	18
43	08288	12103	10304	12678	12268	13264	14182	13862	16048	14470	17
44	08323	12112	10337	12687	12300	13274	14213	13872	16078	14480	16
45	9.08357	0.12122	9.10371	0.12697	9.12332	0.13284	9.14245	0.13882	9.16109	0.14491	15
46	08391	12131	10404	12707	12365	13294	14276	13892	16140	14501	14
47	08425	12141	10437	12717	12397	13304	14307	13902	16170	14511	13
48	08459	12150	10470	12726	12429	13314	14339	13912	16201	14521	12
49	08492	12160	10503	12736	12461	13323	14370	13922	16232	14532	11
50	9.08526	0.12169	9.10536	0.12746	9.12494	0.13333	9.14402	0.13932	9.16262	0.14542	10
51	08560	12179	10569	12755	12526	13343	14433	13942	16293	14552	9
52	08594	12188	10602	12765	12558	13353	14465	13952	16324	14562	8
53	08628	12198	10635	12775	12590	13363	14496	13962	16354	14573	7
54	08662	12207	10668	12784	12622	13373	14527	13972	16385	14583	6
55	9.08696	0.12217	9.10701	0.12794	9.12655	0.13383	9.14559	0.13983	9.16415	0.14593	5
56	08730	12226	10734	12804	12687	13393	14590	13993	16446	14604	4
57	08764	12236	10767	12814	12719	13403	14621	14003	16476	14614	3
58	08797	12245	10800	12823	12751	13412	14653	14013	16507	14624	2
59	08831	12255	10833	12833	12783	13422	14684	14023	16537	14634	1
60	9.08865	0.12265	9.10866	0.12843	9.12815	0.13432	9.14715	0.14033	9.16568	0.14645	0
	319°		318°		317°		316°		315°		

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Haversines

	45°		46°		47°		48°		49°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.16568	0.14645	9.18376	0.15267	9.20140	0.15900	9.21863	0.16543	9.23545	0.17197	60
1	.16598	.14655	.18405	.15278	.20169	.15911	.21891	.16554	.23573	.17208	59
2	.16629	.14665	.18435	.15288	.20198	.15921	.21919	.16565	.23601	.17219	58
3	.16659	.14676	.18465	.15298	.20227	.15932	.21948	.16576	.23629	.17230	57
4	.16690	.14686	.18495	.15309	.20256	.15943	.21976	.16587	.23656	.17241	56
5	9.16720	0.14696	9.18524	0.15319	9.20285	0.15953	9.22004	0.16598	9.23684	0.17252	55
6	.16751	.14706	.18554	.15330	.20314	.15964	.22033	.16608	.23712	.17263	54
7	.16781	.14717	.18584	.15340	.20343	.15975	.22061	.16619	.23739	.17274	53
8	.16812	.14727	.18613	.15351	.20372	.15985	.22089	.16630	.23767	.17285	52
9	.16842	.14737	.18643	.15361	.20401	.15996	.22118	.16641	.23794	.17296	51
10	9.16872	0.14748	9.18673	0.15372	9.20430	0.16007	9.22146	0.16652	9.23822	0.17307	50
11	.16903	.14758	.18702	.15382	.20459	.16017	.22174	.16663	.23850	.17318	49
12	.16933	.14768	.18732	.15393	.20488	.16028	.22202	.16673	.23877	.17329	48
13	.16963	.14779	.18762	.15403	.20517	.16039	.22231	.16684	.23905	.17340	47
14	.16994	.14789	.18791	.15414	.20546	.16049	.22259	.16695	.23932	.17351	46
15	9.17024	0.14799	9.18821	0.15424	9.20574	0.16060	9.22287	0.16706	9.23960	0.17362	45
16	.17054	.14810	.18850	.15435	.20603	.16071	.22315	.16717	.23988	.17373	44
17	.17085	.14820	.18880	.15445	.20632	.16081	.22343	.16728	.24015	.17384	43
18	.17115	.14830	.18909	.15456	.20661	.16092	.22372	.16738	.24043	.17395	42
19	.17145	.14841	.18939	.15466	.20690	.16103	.22400	.16749	.24070	.17406	41
20	9.17175	0.14851	9.18968	0.15477	9.20719	0.16113	9.22428	0.16760	9.24098	0.17417	40
21	.17206	.14861	.18998	.15487	.20748	.16124	.22456	.16771	.24125	.17428	39
22	.17236	.14872	.19027	.15498	.20776	.16135	.22484	.16782	.24153	.17439	38
23	.17266	.14882	.19057	.15508	.20805	.16145	.22512	.16793	.24180	.17450	37
24	.17296	.14892	.19086	.15519	.20834	.16156	.22540	.16804	.24208	.17461	36
25	9.17327	0.14903	9.19116	0.15530	9.20863	0.16167	9.22569	0.16815	9.24235	0.17472	35
26	.17357	.14913	.19145	.15540	.20891	.16178	.22597	.16825	.24263	.17483	34
27	.17387	.14923	.19175	.15551	.20920	.16188	.22625	.16836	.24290	.17494	33
28	.17417	.14934	.19204	.15561	.20949	.16199	.22653	.16847	.24317	.17505	32
29	.17447	.14944	.19234	.15572	.20978	.16210	.22681	.16858	.24345	.17517	31
30	9.17477	0.14955	9.19263	0.15582	9.21006	0.16220	9.22709	0.16869	9.24372	0.17528	30
31	.17507	.14965	.19292	.15593	.21035	.16231	.22737	.16880	.24400	.17539	29
32	.17538	.14975	.19322	.15603	.21064	.16242	.22765	.16891	.24427	.17550	28
33	.17568	.14986	.19351	.15614	.21092	.16253	.22793	.16902	.24454	.17561	27
34	.17598	.14996	.19381	.15624	.21121	.16263	.22821	.16913	.24482	.17572	26
35	9.17628	0.15006	9.19410	0.15635	9.21150	0.16274	9.22849	0.16923	9.24509	0.17583	25
36	.17658	.15017	.19439	.15646	.21178	.16285	.22877	.16934	.24536	.17594	24
37	.17688	.15027	.19469	.15656	.21207	.16296	.22905	.16945	.24564	.17605	23
38	.17718	.15038	.19498	.15667	.21236	.16306	.22933	.16956	.24591	.17616	22
39	.17748	.15048	.19527	.15677	.21264	.16317	.22961	.16967	.24618	.17627	21
40	9.17778	0.15058	9.19557	0.15688	9.21293	0.16328	9.22989	0.16978	9.24646	0.17638	20
41	.17808	.15069	.19586	.15698	.21322	.16339	.23017	.16989	.24673	.17649	19
42	.17838	.15079	.19615	.15709	.21350	.16349	.23045	.17000	.24700	.17661	18
43	.17868	.15090	.19644	.15720	.21379	.16360	.23073	.17011	.24728	.17672	17
44	.17898	.15100	.19674	.15730	.21407	.16371	.23100	.17022	.24755	.17683	16
45	9.17928	0.15110	9.19703	0.15741	9.21436	0.16382	9.23128	0.17033	9.24782	0.17694	15
46	.17958	.15121	.19732	.15751	.21464	.16392	.23156	.17044	.24809	.17705	14
47	.17988	.15131	.19761	.15762	.21493	.16403	.23184	.17055	.24837	.17716	13
48	.18018	.15142	.19790	.15773	.21521	.16414	.23212	.17066	.24864	.17727	12
49	.18048	.15152	.19820	.15783	.21550	.16425	.23240	.17076	.24891	.17738	11
50	9.18077	0.15163	9.19849	0.15794	9.21578	0.16436	9.23268	0.17087	9.24918	0.17749	10
51	.18107	.15173	.19878	.15804	.21607	.16446	.23295	.17098	.24945	.17760	9
52	.18137	.15183	.19907	.15815	.21635	.16457	.23323	.17109	.24973	.17772	8
53	.18167	.15194	.19936	.15826	.21664	.16468	.23351	.17120	.25000	.17783	7
54	.18197	.15204	.19965	.15836	.21692	.16479	.23379	.17131	.25027	.17794	6
55	9.18227	0.15215	9.19995	0.15847	9.21721	0.16489	9.23407	0.17142	9.25054	0.17805	5
56	.18256	.15225	.20024	.15858	.21749	.16500	.23434	.17153	.25081	.17816	4
57	.18286	.15236	.20053	.15868	.21778	.16511	.23462	.17164	.25108	.17827	3
58	.18316	.15246	.20082	.15879	.21806	.16522	.23490	.17175	.25135	.17838	2
59	.18346	.15257	.20111	.15889	.21834	.16533	.23518	.17186	.25163	.17849	1
60	9.18376	0.15267	9.20140	0.15900	9.21863	0.16543	9.23545	0.17197	9.25190	0.17861	0
	314°		313°		312°		311°		310°		

Haversines

	50°		51°		52°		53°		54°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9. 25190	0. 17861	9. 26797	0. 18534	9. 28368	0. 19217	9. 29906	0. 19909	9. 31409	0. 20611	60
1	. 25217	. 17872	. 26823	. 18545	. 28394	. 19228	. 29931	. 19921	. 31434	. 20623	59
2	. 25244	. 17883	. 26850	. 18557	. 28420	. 19240	. 29956	. 19932	. 31459	. 20634	58
3	. 25271	. 17894	. 26876	. 18568	. 28446	. 19251	. 29981	. 19944	. 31484	. 20646	57
4	. 25298	. 17905	. 26903	. 18579	. 28472	. 19263	. 30007	. 19956	. 31508	. 20658	56
5	9. 25325	0. 17916	9. 26929	0. 18591	9. 28498	0. 19274	9. 30032	0. 19967	9. 31533	0. 20670	55
6	. 25352	. 17928	. 26956	. 18602	. 28524	. 19286	. 30057	. 19979	. 31558	. 20681	54
7	. 25379	. 17939	. 26982	. 18613	. 28549	. 19297	. 30083	. 19991	. 31583	. 20693	53
8	. 25406	. 17950	. 27008	. 18624	. 28575	. 19309	. 30108	. 20002	. 31607	. 20705	52
9	. 25433	. 17961	. 27035	. 18636	. 28601	. 19320	. 30133	. 20014	. 31632	. 20717	51
10	9. 25460	0. 17972	9. 27061	0. 18647	9. 28627	0. 19332	9. 30158	0. 20026	9. 31657	0. 20729	50
11	. 25487	. 17983	. 27088	. 18658	. 28653	. 19343	. 30184	. 20037	. 31682	. 20740	49
12	. 25514	. 17995	. 27114	. 18670	. 28679	. 19355	. 30209	. 20049	. 31706	. 20752	48
13	. 25541	. 18006	. 27140	. 18681	. 28704	. 19366	. 30234	. 20060	. 31731	. 20764	47
14	. 25568	. 18017	. 27167	. 18692	. 28730	. 19378	. 30259	. 20072	. 31756	. 20776	46
15	9. 25595	0. 18028	9. 27193	0. 18704	9. 28756	0. 19389	9. 30285	0. 20084	9. 31780	0. 20788	45
16	. 25622	. 18039	. 27219	. 18715	. 28782	. 19401	. 30310	. 20095	. 31805	. 20799	44
17	. 25649	. 18050	. 27246	. 18727	. 28807	. 19412	. 30335	. 20107	. 31830	. 20811	43
18	. 25676	. 18062	. 27272	. 18738	. 28833	. 19424	. 30360	. 20119	. 31854	. 20823	42
19	. 25703	. 18073	. 27298	. 18749	. 28859	. 19435	. 30385	. 20130	. 31879	. 20835	41
20	9. 25729	0. 18084	9. 27325	0. 18761	9. 28885	0. 19447	9. 30410	0. 20142	9. 31903	0. 20847	40
21	. 25756	. 18095	. 27351	. 18772	. 28910	. 19458	. 30436	. 20154	. 31928	. 20858	39
22	. 25783	. 18106	. 27377	. 18783	. 28936	. 19470	. 30461	. 20165	. 31953	. 20870	38
23	. 25810	. 18118	. 27403	. 18795	. 28962	. 19481	. 30486	. 20177	. 31977	. 20882	37
24	. 25837	. 18129	. 27430	. 18806	. 28987	. 19493	. 30511	. 20189	. 32002	. 20894	36
25	9. 25864	0. 18140	9. 27456	0. 18817	9. 29013	0. 19504	9. 30536	0. 20200	9. 32026	0. 20906	35
26	. 25891	. 18151	. 27482	. 18829	. 29039	. 19516	. 30561	. 20212	. 32051	. 20918	34
27	. 25917	. 18162	. 27508	. 18840	. 29064	. 19527	. 30586	. 20224	. 32076	. 20929	33
28	. 25944	. 18174	. 27535	. 18852	. 29090	. 19539	. 30611	. 20235	. 32100	. 20941	32
29	. 25971	. 18185	. 27561	. 18863	. 29116	. 19550	. 30636	. 20247	. 32125	. 20953	31
30	9. 25998	0. 18196	9. 27587	0. 18874	9. 29141	0. 19562	9. 30662	0. 20259	9. 32149	0. 20965	30
31	. 26025	. 18207	. 27613	. 18886	. 29167	. 19573	. 30687	. 20271	. 32174	. 20977	29
32	. 26051	. 18219	. 27639	. 18897	. 29192	. 19585	. 30712	. 20282	. 32198	. 20989	28
33	. 26078	. 18230	. 27666	. 18908	. 29218	. 19597	. 30737	. 20294	. 32223	. 21000	27
34	. 26105	. 18241	. 27692	. 18920	. 29244	. 19608	. 30762	. 20306	. 32247	. 21012	26
35	9. 26132	0. 18252	9. 27718	0. 18931	9. 29269	0. 19620	9. 30787	0. 20317	9. 32272	0. 21024	25
36	. 26158	. 18263	. 27744	. 18943	. 29295	. 19631	. 30812	. 20329	. 32296	. 21036	24
37	. 26185	. 18275	. 27770	. 18954	. 29320	. 19643	. 30837	. 20341	. 32321	. 21048	23
38	. 26212	. 18286	. 27796	. 18965	. 29346	. 19654	. 30862	. 20352	. 32345	. 21060	22
39	. 26238	. 18297	. 27822	. 18977	. 29371	. 19666	. 30887	. 20364	. 32370	. 21072	21
40	9. 26265	0. 18308	9. 27848	0. 18988	9. 29397	0. 19677	9. 30912	0. 20376	9. 32394	0. 21083	20
41	. 26292	. 18320	. 27875	. 19000	. 29422	. 19689	. 30937	. 20388	. 32418	. 21095	19
42	. 26319	. 18331	. 27901	. 19011	. 29448	. 19701	. 30962	. 20399	. 32443	. 21107	18
43	. 26345	. 18342	. 27927	. 19022	. 29473	. 19712	. 30987	. 20411	. 32467	. 21119	17
44	. 26372	. 18353	. 27953	. 19034	. 29499	. 19724	. 31012	. 20423	. 32492	. 21131	16
45	9. 26398	0. 18365	9. 27979	0. 19045	9. 29524	0. 19735	9. 31036	0. 20435	9. 32516	0. 21143	15
46	. 26425	. 18376	. 28005	. 19057	. 29550	. 19747	. 31061	. 20446	. 32541	. 21155	14
47	. 26452	. 18387	. 28031	. 19068	. 29575	. 19758	. 31086	. 20458	. 32565	. 21167	13
48	. 26478	. 18399	. 28057	. 19080	. 29601	. 19770	. 31111	. 20470	. 32589	. 21178	12
49	. 26505	. 18410	. 28083	. 19091	. 29626	. 19782	. 31136	. 20481	. 32614	. 21190	11
50	9. 26532	0. 18421	9. 28109	0. 19102	9. 29652	0. 19793	9. 31161	0. 20493	9. 32638	0. 21202	10
51	. 26558	. 18432	. 28135	. 19114	. 29677	. 19805	. 31186	. 20505	. 32662	. 21214	9
52	. 26585	. 18444	. 28161	. 19125	. 29703	. 19816	. 31211	. 20517	. 32687	. 21226	8
53	. 26611	. 18455	. 28187	. 19137	. 29728	. 19828	. 31236	. 20528	. 32711	. 21238	7
54	. 26638	. 18466	. 28213	. 19148	. 29753	. 19840	. 31260	. 20540	. 32735	. 21250	6
55	9. 26664	0. 18477	9. 28239	0. 19160	9. 29779	0. 19851	9. 31285	0. 20552	9. 32760	0. 21262	5
56	. 26691	. 18489	. 28265	. 19171	. 29804	. 19863	. 31310	. 20564	. 32784	. 21274	4
57	. 26717	. 18500	. 28291	. 19183	. 29829	. 19874	. 31335	. 20575	. 32808	. 21285	3
58	. 26744	. 18511	. 28317	. 19194	. 29855	. 19886	. 31360	. 20587	. 32833	. 21297	2
59	. 26770	. 18523	. 28342	. 19205	. 29880	. 19898	. 31385	. 20599	. 32857	. 21309	1
60	9. 26797	0. 18534	9. 28368	0. 19217	9. 29906	0. 19909	9. 31409	0. 20611	9. 32881	0. 21321	0
	309°		308°		307°		306°		305°		

2

Haversines

	55°		56°		57°		58°		59°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.32881	0.21321	9.34322	0.22040	9.35733	0.22768	9.37114	0.23504	9.38468	0.24248	60
1	32905	21333	34346	22052	35756	22780	37137	23516	38490	24261	59
2	32930	21345	34369	22064	35779	22792	37160	23529	38512	24273	58
3	32954	21357	34393	22077	35802	22805	37183	23541	38535	24286	57
4	32978	21369	34417	22089	35826	22817	37205	23553	38557	24298	56
5	33002	0.21381	9.34441	0.22101	9.35849	0.22829	9.37228	0.23566	9.38579	0.24310	55
6	33027	21393	34464	22113	35872	22841	37251	23578	38602	24323	54
7	33051	21405	34488	22125	35895	22853	37274	23590	38624	24335	53
8	33075	21417	34512	22137	35918	22866	37296	23603	38646	24348	52
9	33099	21429	34535	22149	35942	22878	37319	23615	38668	24360	51
10	9.33123	0.21440	9.34559	0.22161	9.35965	0.22890	9.37342	0.23627	9.38691	0.24373	50
11	33148	21452	34583	22173	35988	22902	37364	23640	38713	24385	49
12	33172	21464	34606	22185	36011	22915	37387	23652	38735	24398	48
13	33196	21476	34630	22197	36034	22927	37410	23665	38757	24410	47
14	33220	21488	34654	22209	36058	22939	37433	23677	38780	24423	46
15	9.33244	0.21500	9.34677	0.22221	9.36081	0.22951	9.37455	0.23689	9.38926	0.24435	45
16	33268	21512	34701	22234	36104	22964	37478	23702	38824	24448	44
17	33292	21524	34725	22246	36127	22976	37501	23714	38846	24460	43
18	33317	21536	34748	22258	36153	22988	37523	23726	38868	24473	42
19	33341	21548	34772	22270	36173	23000	37546	23739	38891	24485	41
20	9.33365	0.21560	9.34795	0.22282	9.36196	0.23012	9.37569	0.23751	9.38913	0.24498	40
21	33389	21572	34819	22294	36219	23025	37591	23764	38935	24510	39
22	33413	21584	34843	22306	36243	23037	37614	23776	38957	24523	38
23	33437	21596	34866	22318	36266	23049	37636	23788	38979	24535	37
24	33461	21608	34890	22330	36289	23061	37659	23801	39002	24548	36
25	9.33485	0.21620	9.34913	0.22343	9.36312	0.23074	9.37682	0.23813	9.39024	0.24560	35
26	33509	21632	34937	22355	36335	23086	37704	23825	39046	24573	34
27	33533	21644	34960	22367	36358	23098	37727	23838	39068	24585	33
28	33557	21656	34984	22379	36381	23110	37749	23850	39090	24598	32
29	33581	21668	35007	22391	36404	23123	37772	23863	39112	24611	31
30	9.33605	0.21680	9.35030	0.22403	9.36427	0.23135	9.37794	0.23875	9.39134	0.24623	30
31	33629	21692	35054	22415	36450	23147	37817	23887	39156	24636	29
32	33653	21704	35078	22427	36473	23160	37840	23900	39178	24648	28
33	33677	21716	35101	22440	36496	23172	37862	23912	39201	24661	27
34	33701	21728	35125	22452	36519	23184	37885	23925	39223	24673	26
35	9.33725	0.21740	9.35148	0.22464	9.36542	0.23196	9.37907	0.23937	9.39245	0.24686	25
36	33749	21752	35172	22476	36565	23209	37930	23950	39267	24698	24
37	33773	21764	35195	22488	36588	23221	37952	23962	39289	24711	23
38	33797	21776	35218	22500	36611	23233	37975	23974	39311	24723	22
39	33821	21788	35242	22512	36634	23246	37997	23987	39333	24736	21
40	9.33845	0.21800	9.35266	0.22525	9.36657	0.23258	9.38020	0.23999	9.39355	0.24749	20
41	33869	21812	35289	22537	36680	23270	38042	24012	39377	24761	19
42	33893	21824	35312	22549	36703	23282	38065	24024	39399	24774	18
43	33917	21836	35336	22561	36726	23295	38087	24036	39421	24786	17
44	33941	21848	35359	22573	36749	23307	38110	24049	39443	24799	16
45	9.33965	0.21860	9.35383	0.22585	9.36772	0.23319	9.38132	0.24061	9.39465	0.24811	15
46	33988	21872	35406	22598	36794	23332	38154	24074	39487	24824	14
47	34012	21884	35429	22610	36817	23344	38177	24086	39509	24836	13
48	34036	21896	35453	22622	36840	23356	38199	24099	39531	24849	12
49	34060	21908	35476	22634	36863	23368	38222	24111	39553	24862	11
50	9.34084	0.21920	9.35500	0.22646	9.36886	0.23381	9.38244	0.24124	9.39575	0.24874	10
51	34108	21932	35523	22658	36909	23393	38267	24136	39597	24887	9
52	34132	21944	35546	22671	36932	23405	38289	24148	39619	24899	8
53	34155	21956	35570	22683	36955	23418	38311	24161	39641	24912	7
54	34179	21968	35593	22695	36977	23430	38334	24173	39663	24924	6
55	9.34203	0.21980	9.35616	0.22707	9.37000	0.23442	9.38356	0.24186	9.39685	0.24937	5
56	34227	21992	35639	22719	37023	23455	38378	24198	39706	24950	4
57	34251	22004	35663	22731	37046	23467	38401	24211	39728	24962	3
58	34274	22016	35686	22744	37069	23479	38423	24223	39750	24975	2
59	34298	22028	35709	22756	37091	23492	38445	24236	39772	24987	1
60	9.34322	0.22040	9.35733	0.22768	9.37114	0.23504	9.38468	0.24248	9.39794	0.25000	0

Haversines

2

	60°		61°		62°		63°		64°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.39794	0.25000	9.41094	0.25760	9.42368	0.26526	9.43617	0.27300	9.44842	0.28081	60
1	39816	25013	41115	25772	42389	26539	43638	27313	44862	28095	59
2	39838	25025	41137	25785	42410	26552	43658	27326	44882	28108	58
3	39860	25038	41158	25798	42431	26565	43679	27339	44903	28121	57
4	39881	25050	41180	25810	42452	26578	43699	27352	44923	28134	56
5	9.39903	0.25063	9.41201	0.25823	9.42473	0.26591	9.43720	0.27365	9.44943	0.28147	55
6	39925	25076	41222	25836	42494	26604	43741	27378	44963	28160	54
7	39947	25088	41244	25849	42515	26616	43761	27391	44983	28173	53
8	39969	25101	41265	25861	42536	26629	43782	27404	45003	28186	52
9	39991	25113	41287	25874	42557	26642	43802	27417	45024	28199	51
10	9.40012	0.25126	9.41308	0.25887	9.42578	0.26655	9.43823	0.27430	9.45044	0.28212	50
11	40034	25139	41329	25900	42599	26668	43843	27443	45064	28225	49
12	40056	25151	41351	25912	42620	26681	43864	27456	45084	28238	48
13	40078	25164	41372	25925	42641	26694	43884	27469	45104	28252	47
14	40100	25177	41393	25938	42662	26706	43905	27482	45124	28265	46
15	9.40121	0.25189	9.41415	0.25951	9.42682	0.26719	9.43926	0.27495	9.45144	0.28278	45
16	40143	25202	41436	25963	42703	26732	43946	27508	45165	28291	44
17	40165	25214	41457	25976	42724	26745	43967	27521	45185	28304	43
18	40187	25227	41479	25989	42745	26758	43987	27534	45205	28317	42
19	40208	25240	41500	26002	42766	26771	44008	27547	45225	28330	41
20	9.40230	0.25252	9.41521	0.26014	9.42787	0.26784	9.44028	0.27560	9.45245	0.28343	40
21	40252	25265	41543	26027	42808	26797	44048	27573	45265	28356	39
22	40274	25278	41564	26040	42829	26809	44069	27586	45285	28369	38
23	40295	25290	41585	26053	42850	26822	44089	27599	45305	28383	37
24	40317	25303	41606	26065	42870	26835	44110	27612	45325	28396	36
25	9.40339	0.25316	9.41628	0.26078	9.42891	0.26848	9.44130	0.27625	9.45345	0.28409	35
26	40360	25328	41649	26091	42912	26861	44151	27638	45365	28422	34
27	40382	25341	41670	26104	42933	26874	44171	27651	45385	28435	33
28	40404	25354	41692	26117	42954	26887	44192	27664	45405	28448	32
29	40425	25366	41713	26129	42975	26900	44212	27677	45426	28461	31
30	9.40447	0.25379	9.41734	0.26142	9.42996	0.26913	9.44232	0.27690	9.45446	0.28474	30
31	40469	25391	41755	26155	43016	26925	44253	27703	45466	28488	29
32	40490	25404	41776	26168	43037	26938	44273	27716	45486	28501	28
33	40512	25417	41798	26180	43058	26951	44294	27729	45506	28514	27
34	40534	25429	41819	26193	43079	26964	44314	27742	45526	28527	26
35	9.40555	0.25442	9.41840	0.26206	9.43100	0.26977	9.44334	0.27755	9.45546	0.28540	25
36	40577	25455	41861	26219	43120	26990	44355	27768	45566	28553	24
37	40599	25467	41882	26232	43141	27003	44375	27781	45586	28566	23
38	40620	25480	41904	26244	43162	27016	44396	27794	45606	28580	22
39	40642	25493	41925	26257	43183	27029	44416	27807	45625	28593	21
40	9.40663	0.25506	9.41946	0.26270	9.43203	0.27042	9.44436	0.27820	9.45645	0.28606	20
41	40685	25518	41967	26283	43224	27055	44457	27833	45665	28619	19
42	40707	25531	41988	26296	43245	27068	44477	27846	45685	28632	18
43	40728	25544	42009	26308	43266	27080	44497	27859	45705	28645	17
44	40750	25556	42031	26321	43286	27093	44518	27873	45725	28658	16
45	9.40771	0.25569	9.42052	0.26334	9.43307	0.27106	9.44538	0.27886	9.45745	0.28672	15
46	40793	25582	42073	26347	43328	27119	44558	27899	45765	28685	14
47	40814	25594	42094	26360	43348	27132	44579	27912	45785	28698	13
48	40836	25607	42115	26372	43369	27145	44599	27925	45805	28711	12
49	40858	25620	42136	26385	43390	27158	44619	27938	45825	28724	11
50	9.40879	0.25632	9.42157	0.26398	9.43411	0.27171	9.44639	0.27951	9.45845	0.28737	10
51	40900	25645	42178	26411	43431	27184	44660	27964	45865	28751	9
52	40922	25658	42199	26424	43452	27197	44680	27977	45884	28764	8
53	40943	25671	42221	26437	43473	27210	44700	27990	45904	28777	7
54	40965	25683	42242	26449	43493	27223	44721	28003	45924	28790	6
55	9.40986	0.25696	9.42263	0.26462	9.43514	0.27236	9.44741	0.28016	9.45944	0.28803	5
56	41008	25709	42284	26475	43535	27249	44761	28029	45964	28816	4
57	41029	25721	42305	26488	43555	27262	44781	28042	45984	28830	3
58	41051	25734	42326	26501	43576	27275	44801	28055	46004	28843	2
59	41072	25747	42347	26514	43596	27288	44822	28068	46023	28856	1
60	9.41094	0.25760	9.42368	0.26526	9.43617	0.27300	9.44842	0.28081	9.46043	0.28869	0
	299°		298°		297°		296°		295°		

②

Haversines

	65°		66°		67°		68°		69°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.46043	0.28869	9.47222	0.29663	9.48378	0.30463	9.49512	0.31270	9.50626	0.32082	60
1	.46063	.28882	.47241	.29676	.48397	.30477	.49531	.31283	.50644	.32095	59
2	.46083	.28895	.47261	.29690	.48416	.30490	.49550	.31297	.50662	.32109	58
3	.46103	.28909	.47280	.29703	.48435	.30504	.49568	.31310	.50681	.32122	57
4	.46123	.28922	.47300	.29716	.48454	.30517	.49587	.31324	.50699	.32136	56
5	9.46142	0.28935	9.47319	0.29730	9.48473	0.30530	9.49606	0.31337	9.50717	0.32150	55
6	.46162	.28948	.47338	.29743	.48492	.30544	.49625	.31351	.50736	.32163	54
7	.46182	.28961	.47358	.29756	.48511	.30557	.49643	.31364	.50754	.32177	53
8	.46202	.28975	.47377	.29770	.48530	.30571	.49662	.31378	.50772	.32190	52
9	.46222	.28988	.47397	.29783	.48549	.30584	.49681	.31391	.50791	.32204	51
10	9.46241	0.29001	9.47416	0.29796	9.48568	0.30597	9.49690	0.31405	9.50809	0.32217	50
11	.46261	.29014	.47435	.29809	.48587	.30611	.49718	.31418	.50827	.32231	49
12	.46281	.29027	.47455	.29823	.48607	.30624	.49737	.31432	.50846	.32245	48
13	.46301	.29041	.47474	.29836	.48626	.30638	.49755	.31445	.50864	.32258	47
14	.46320	.29054	.47493	.29849	.48645	.30651	.49774	.31459	.50882	.32272	46
15	9.46340	0.29067	9.47513	0.29863	9.48664	0.30664	9.49793	0.31472	9.50901	0.32285	45
16	.46360	.29080	.47532	.29876	.48683	.30678	.49811	.31486	.50919	.32299	44
17	.46380	.29093	.47552	.29889	.48702	.30691	.49830	.31499	.50937	.32313	43
18	.46399	.29107	.47571	.29903	.48720	.30705	.49849	.31513	.50956	.32326	42
19	.46419	.29120	.47590	.29916	.48739	.30718	.49867	.31526	.50974	.32340	41
20	9.46439	0.29133	9.47610	0.29929	9.48758	0.30732	9.49886	0.31540	9.50992	0.32353	40
21	.46458	.29146	.47629	.29943	.48777	.30745	.49904	.31553	.51010	.32367	39
22	.46478	.29160	.47648	.29956	.48796	.30758	.49923	.31567	.51029	.32381	38
23	.46498	.29173	.47668	.29969	.48815	.30772	.49942	.31580	.51047	.32394	37
24	.46517	.29186	.47687	.29983	.48834	.30785	.49960	.31594	.51065	.32408	36
25	9.46537	0.29199	9.47706	0.29996	9.48853	0.30799	9.49979	0.31607	9.51083	0.32422	35
26	.46557	.29212	.47725	.30009	.48872	.30812	.49997	.31621	.51102	.32435	34
27	.46576	.29226	.47745	.30023	.48891	.30826	.50016	.31634	.51120	.32449	33
28	.46596	.29239	.47764	.30036	.48910	.30839	.50034	.31648	.51138	.32462	32
29	.46616	.29252	.47783	.30049	.48929	.30852	.50053	.31661	.51156	.32476	31
30	9.46635	0.29265	9.47803	0.30063	9.48948	0.30866	9.50072	0.31675	9.51174	0.32490	30
31	.46655	.29279	.47822	.30076	.48967	.30879	.50090	.31688	.51193	.32503	29
32	.46675	.29292	.47841	.30089	.48986	.30893	.50109	.31702	.51211	.32517	28
33	.46694	.29305	.47860	.30103	.49004	.30906	.50127	.31716	.51229	.32531	27
34	.46714	.29318	.47880	.30116	.49023	.30920	.50146	.31729	.51247	.32544	26
35	9.46733	0.29332	9.47899	0.30129	9.49042	0.30933	9.50164	0.31743	9.51265	0.32558	25
36	.46753	.29345	.47918	.30143	.49061	.30946	.50183	.31756	.51284	.32571	24
37	.46773	.29358	.47937	.30156	.49080	.30960	.50201	.31770	.51302	.32585	23
38	.46792	.29371	.47957	.30169	.49099	.30973	.50220	.31783	.51320	.32599	22
39	.46812	.29385	.47976	.30183	.49118	.30987	.50238	.31797	.51338	.32612	21
40	9.46831	0.29398	9.47995	0.30196	9.49137	0.31000	9.50257	0.31810	9.51356	0.32626	20
41	.46851	.29411	.48014	.30209	.49155	.31014	.50275	.31824	.51374	.32640	19
42	.46871	.29424	.48033	.30223	.49174	.31027	.50294	.31837	.51393	.32653	18
43	.46890	.29438	.48053	.30236	.49193	.31041	.50312	.31851	.51411	.32667	17
44	.46910	.29451	.48072	.30249	.49212	.31054	.50331	.31865	.51429	.32681	16
45	9.46929	0.29464	9.48091	0.30263	9.49231	0.31068	9.50349	0.31878	9.51447	0.32694	15
46	.46949	.29477	.48110	.30276	.49250	.31081	.50368	.31892	.51465	.32708	14
47	.46968	.29491	.48129	.30290	.49268	.31094	.50386	.31905	.51483	.32721	13
48	.46988	.29504	.48148	.30303	.49287	.31108	.50405	.31919	.51501	.32735	12
49	.47007	.29517	.48168	.30316	.49306	.31121	.50423	.31932	.51519	.32749	11
50	9.47027	0.29530	9.48187	0.30330	9.49325	0.31135	9.50442	0.31946	9.51538	0.32762	10
51	.47046	.29544	.48206	.30343	.49344	.31148	.50460	.31959	.51556	.32776	9
52	.47066	.29557	.48225	.30356	.49362	.31162	.50478	.31973	.51574	.32790	8
53	.47085	.29570	.48244	.30370	.49381	.31175	.50497	.31987	.51592	.32803	7
54	.47105	.29583	.48263	.30383	.49400	.31189	.50515	.32000	.51610	.32817	6
55	9.47124	0.29597	9.48282	0.30397	9.49419	0.31202	9.50534	0.32014	9.51628	0.32831	5
56	.47144	.29610	.48302	.30410	.49437	.31216	.50552	.32027	.51646	.32844	4
57	.47163	.29623	.48321	.30423	.49456	.31229	.50570	.32041	.51664	.32858	3
58	.47183	.29637	.48340	.30437	.49475	.31243	.50589	.32054	.51682	.32872	2
59	.47202	.29650	.48359	.30450	.49494	.31256	.50607	.32068	.51700	.32885	1
60	9.47222	0.29663	9.48378	0.30463	9.49512	0.31270	9.50626	0.32082	9.51718	0.32899	0
	294°		293°		292°		291°		290°		

Haversines

	70°		71°		72°		73°		74°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9. 51718	0. 32899	9. 52791	0. 33722	9. 53844	0. 34549	9. 54878	0. 35381	9. 55893	0. 36218	60
1	51736	32913	52809	33735	53861	34563	54895	35395	55909	36232	59
2	51754	32926	52826	33749	53879	34577	54912	35409	55926	36246	58
3	51772	32940	52844	33763	53896	34591	54929	35423	55943	36260	57
4	51790	32954	52862	33777	53913	34604	54946	35437	55960	36274	56
5	9. 51808	0. 32967	9. 52879	0. 33790	9. 53931	0. 34618	9. 54963	0. 35451	9. 55976	0. 36288	55
6	51826	32981	52897	33804	53948	34632	54980	35465	55993	36302	54
7	51844	32995	52915	33818	53966	34646	54997	35479	56010	36316	53
8	51862	33008	52932	33832	53983	34660	55014	35493	56027	36330	52
9	51880	33022	52950	33845	54000	34674	55031	35507	56043	36344	51
10	9. 51898	0. 33036	9. 52968	0. 33859	9. 54017	0. 34688	9. 55048	0. 35521	9. 56060	0. 36358	50
11	51916	33049	52985	33873	54035	34701	55065	35534	56077	36372	49
12	51934	33063	53003	33887	54052	34715	55082	35548	56093	36386	48
13	51952	33077	53021	33900	54069	34729	55099	35562	56110	36400	47
14	51970	33090	53038	33914	54087	34743	55116	35576	56127	36414	46
15	9. 51988	0. 33104	9. 53056	0. 33928	9. 54104	0. 34757	9. 55133	0. 35590	9. 56144	0. 36428	45
16	52006	33118	53073	33942	54121	34771	55150	35604	56160	36442	44
17	52024	33132	53091	33956	54139	34784	55167	35618	56177	36456	43
18	52042	33145	53109	33969	54156	34798	55184	35632	56194	36470	42
19	52060	33159	53126	33983	54173	34812	55201	35646	56210	36484	41
20	9. 52078	0. 33173	9. 53144	0. 33997	9. 54190	0. 34826	9. 55218	0. 35660	9. 56227	0. 36498	40
21	52096	33186	53162	34011	54208	34840	55235	35674	56244	36512	39
22	52114	33200	53179	34024	54225	34854	55252	35688	56260	36526	38
23	52132	33214	53197	34038	54242	34868	55269	35702	56277	36540	37
24	52150	33227	53214	34052	54260	34882	55286	35716	56294	36554	36
25	9. 52168	0. 33241	9. 53232	0. 34066	9. 54277	0. 34895	9. 55303	0. 35730	9. 56310	0. 36568	35
26	52185	33255	53249	34080	54294	34909	55320	35743	56327	36582	34
27	52203	33269	53267	34093	54311	34923	55337	35757	56343	36596	33
28	52221	33282	53285	34107	54329	34937	55354	35771	56360	36610	32
29	52239	33296	53302	34121	54346	34951	55370	35785	56377	36624	31
30	9. 52257	0. 33310	9. 53320	0. 34135	9. 54363	0. 34965	9. 55387	0. 35799	9. 56393	0. 36638	30
31	52275	33323	53337	34149	54380	34979	55404	35813	56410	36652	29
32	52293	33337	53355	34162	54397	34992	55421	35827	56426	36666	28
33	52311	33351	53372	34176	54415	35006	55438	35841	56443	36680	27
34	52328	33365	53390	34190	54432	35020	55455	35855	56460	36694	26
35	9. 52346	0. 33378	9. 53407	0. 34204	9. 54449	0. 35034	9. 55472	0. 35869	9. 56476	0. 36708	25
36	52364	33392	53425	34218	54466	35048	55489	35883	56493	36722	24
37	52382	33406	53442	34231	54483	35062	55506	35897	56509	36736	23
38	52400	33419	53460	34245	54501	35076	55523	35911	56526	36750	22
39	52418	33433	53477	34259	54518	35090	55539	35925	56543	36764	21
40	9. 52436	0. 33447	9. 53495	0. 34273	9. 54535	0. 35103	9. 55556	0. 35939	9. 56559	0. 36778	20
41	52453	33461	53512	34287	54552	35117	55573	35953	56576	36792	19
42	52471	33474	53530	34300	54569	35131	55590	35967	56592	36806	18
43	52489	33488	53547	34314	54587	35145	55607	35981	56609	36820	17
44	52507	33502	53565	34328	54604	35159	55624	35995	56625	36834	16
45	9. 52525	0. 33515	9. 53582	0. 34342	9. 54621	0. 35173	9. 55641	0. 36009	9. 56642	0. 36848	15
46	52542	33529	53600	34356	54638	35187	55657	36023	56658	36862	14
47	52560	33543	53617	34369	54655	35201	55674	36036	56675	36877	13
48	52578	33557	53635	34383	54672	35215	55691	36050	56692	36891	12
49	52596	33570	53652	34397	54689	35228	55708	36064	56708	36905	11
50	9. 52613	0. 33584	9. 53670	0. 34411	9. 54707	0. 35242	9. 55725	0. 36078	9. 56725	0. 36919	10
51	52631	33598	53687	34425	54724	35256	55742	36092	56741	36933	9
52	52649	33612	53704	34439	54741	35270	55758	36106	56758	36947	8
53	52667	33625	53722	34452	54758	35284	55775	36120	56774	36961	7
54	52684	33639	53739	34466	54775	35298	55792	36134	56791	36975	6
55	9. 52702	0. 33653	9. 53757	0. 34480	9. 54792	0. 35312	9. 55809	0. 36148	9. 56807	0. 36989	5
56	52720	33667	53774	34494	54809	35326	55826	36162	56824	37003	4
57	52738	33680	53792	34508	54826	35340	55842	36176	56840	37017	3
58	52755	33694	53809	34521	54843	35354	55859	36190	56856	37031	2
59	52773	33708	53826	34535	54860	35368	55876	36204	56873	37045	1
60	9. 52791	0. 33722	9. 53844	0. 34549	9. 54878	0. 35381	9. 55893	0. 36218	9. 56889	0. 37059	0
	289°		288°		287°		286°		285°		

2

Haversines

	75°		76°		77°		78°		79°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.56889	0.37059	9.57868	0.37904	9.58830	0.38752	9.59774	0.39604	9.60702	0.40460	60
1	.56906	.37073	.57885	.37918	.58846	.38767	.59790	.39619	.60717	.40474	59
2	.56922	.37087	.57901	.37932	.58862	.38781	.59806	.39633	.60733	.40488	58
3	.56939	.37101	.57917	.37946	.58878	.38795	.59821	.39647	.60748	.40502	57
4	.56955	.37115	.57933	.37960	.58893	.38809	.59837	.39661	.60763	.40517	56
5	9.56972	0.37129	9.57949	0.37974	9.58909	0.38823	9.59852	0.39676	9.60779	0.40531	55
6	.56988	.37143	.57965	.37989	.58925	.38837	.59868	.39690	.60794	.40545	54
7	.57005	.37157	.57981	.38003	.58941	.38852	.59883	.39704	.60809	.40560	53
8	.57021	.37171	.57998	.38017	.58957	.38866	.59899	.39718	.60825	.40574	52
9	.57037	.37186	.58014	.38031	.58973	.38880	.59915	.39732	.60840	.40588	51
10	9.57054	0.37200	9.58030	0.38045	9.58989	0.38894	9.59930	0.39747	9.60855	0.40602	50
11	.57070	.37214	.58046	.38059	.59004	.38908	.59946	.39761	.60870	.40617	49
12	.57087	.37228	.58062	.38073	.59020	.38923	.59961	.39775	.60886	.40631	48
13	.57103	.37242	.58078	.38087	.59036	.38937	.59977	.39789	.60901	.40645	47
14	.57119	.37256	.58094	.38102	.59052	.38951	.59992	.39804	.60916	.40660	46
15	9.57136	0.37270	9.58110	0.38116	9.59068	0.38965	9.60008	0.39818	9.60931	0.40674	45
16	.57152	.37284	.58126	.38130	.59083	.38979	.60023	.39832	.60947	.40688	44
17	.57169	.37298	.58143	.38144	.59099	.38994	.60039	.39846	.60962	.40702	43
18	.57185	.37312	.58159	.38158	.59115	.39008	.60054	.39861	.60977	.40717	42
19	.57201	.37326	.58175	.38172	.59131	.39022	.60070	.39875	.60992	.40731	41
20	9.57218	0.37340	9.58191	0.38186	9.59147	0.39036	9.60085	0.39889	9.61008	0.40745	40
21	.57234	.37354	.58207	.38200	.59162	.39050	.60101	.39903	.61023	.40760	39
22	.57250	.37368	.58223	.38215	.59178	.39064	.60116	.39918	.61038	.40774	38
23	.57267	.37382	.58239	.38229	.59194	.39079	.60132	.39932	.61053	.40788	37
24	.57283	.37397	.58255	.38243	.59210	.39093	.60147	.39946	.61069	.40802	36
25	9.57299	0.37411	9.58271	0.38257	9.59225	0.39107	9.60163	0.39960	9.61084	0.40817	35
26	.57316	.37425	.58287	.38271	.59241	.39121	.60178	.39975	.61099	.40831	34
27	.57332	.37439	.58303	.38285	.59257	.39135	.60194	.39989	.61114	.40845	33
28	.57348	.37453	.58319	.38299	.59273	.39150	.60209	.40003	.61129	.40860	32
29	.57365	.37467	.58335	.38314	.59289	.39164	.60225	.40017	.61145	.40874	31
30	9.57381	0.37481	9.58351	0.38328	9.59304	0.39178	9.60240	0.40032	9.61160	0.40888	30
31	.57397	.37495	.58367	.38342	.59320	.39192	.60256	.40046	.61175	.40903	29
32	.57414	.37509	.58383	.38356	.59336	.39206	.60271	.40060	.61190	.40917	28
33	.57430	.37523	.58399	.38370	.59351	.39221	.60287	.40074	.61205	.40931	27
34	.57446	.37537	.58415	.38384	.59367	.39235	.60302	.40089	.61221	.40945	26
35	9.57463	0.37551	9.58431	0.38398	9.59383	0.39249	9.60318	0.40103	9.61236	0.40960	25
36	.57479	.37566	.58447	.38413	.59399	.39263	.60333	.40117	.61251	.40974	24
37	.57495	.37580	.58463	.38427	.59414	.39277	.60348	.40131	.61266	.40988	23
38	.57511	.37594	.58479	.38441	.59430	.39292	.60364	.40146	.61281	.41003	22
39	.57528	.37608	.58495	.38455	.59446	.39306	.60379	.40160	.61296	.41017	21
40	9.57544	0.37622	9.58511	0.38469	9.59461	0.39320	9.60395	0.40174	9.61312	0.41031	20
41	.57560	.37636	.58527	.38483	.59477	.39334	.60410	.40188	.61327	.41046	19
42	.57577	.37650	.58543	.38498	.59493	.39348	.60426	.40203	.61342	.41060	18
43	.57593	.37664	.58559	.38512	.59508	.39363	.60441	.40217	.61357	.41074	17
44	.57609	.37678	.58575	.38526	.59524	.39377	.60456	.40231	.61372	.41089	16
45	9.57625	0.37692	9.58591	0.38540	9.59540	0.39391	9.60472	0.40245	9.61387	0.41103	15
46	.57642	.37706	.58607	.38554	.59556	.39405	.60487	.40260	.61402	.41117	14
47	.57658	.37721	.58623	.38568	.59571	.39420	.60502	.40274	.61417	.41131	13
48	.57674	.37735	.58639	.38582	.59587	.39434	.60518	.40288	.61433	.41146	12
49	.57690	.37749	.58655	.38597	.59602	.39448	.60533	.40303	.61448	.41160	11
50	9.57706	0.37763	9.58671	0.38611	9.59618	0.39462	9.60549	0.40317	9.61463	0.41174	10
51	.57723	.37777	.58687	.38625	.59634	.39476	.60564	.40331	.61478	.41189	9
52	.57739	.37791	.58703	.38639	.59649	.39491	.60579	.40345	.61493	.41203	8
53	.57755	.37805	.58719	.38653	.59665	.39505	.60595	.40360	.61508	.41217	7
54	.57771	.37819	.58735	.38667	.59681	.39519	.60610	.40374	.61523	.41232	6
55	9.57787	0.37833	9.58750	0.38682	9.59696	0.39533	9.60625	0.40388	9.61538	0.41246	5
56	.57804	.37847	.58766	.38696	.59712	.39548	.60641	.40402	.61553	.41260	4
57	.57820	.37862	.58782	.38710	.59728	.39562	.60656	.40417	.61568	.41275	3
58	.57836	.37876	.58798	.38724	.59743	.39576	.60671	.40431	.61583	.41289	2
59	.57852	.37890	.58814	.38738	.59759	.39590	.60687	.40445	.61598	.41303	1
60	9.57868	0.37904	9.58830	0.38752	9.59774	0.39604	9.60702	0.40460	9.61614	0.41318	0
	284°		283°		282°		281°		280°		

Haversines

	80°		81°		82°		83°		84°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9. 61614	0. 41318	9. 62509	0. 42178	9. 63389	0. 43041	9. 64253	0. 43907	9. 65102	0. 44774	60
1	. 61629	. 41332	. 62524	. 42193	. 63403	. 43056	. 64267	. 43921	. 65116	. 44788	59
2	. 61644	. 41346	. 62538	. 42207	. 63418	. 43070	. 64281	. 43935	. 65130	. 44803	58
3	. 61659	. 41361	. 62553	. 42221	. 63432	. 43085	. 64296	. 43950	. 65144	. 44817	57
4	. 61674	. 41375	. 62568	. 42236	. 63447	. 43099	. 64310	. 43964	. 65158	. 44831	56
5	9. 61689	0. 41389	9. 62583	0. 42250	9. 63461	0. 43113	9. 64324	0. 43979	9. 65172	0. 44846	55
6	. 61704	. 41404	. 62598	. 42264	. 63476	. 43128	. 64339	. 43993	. 65186	. 44860	54
7	. 61719	. 41418	. 62612	. 42279	. 63490	. 43142	. 64353	. 44008	. 65200	. 44875	53
8	. 61734	. 41432	. 62627	. 42293	. 63505	. 43157	. 64367	. 44022	. 65214	. 44889	52
9	. 61749	. 41447	. 62642	. 42308	. 63519	. 43171	. 64381	. 44036	. 65228	. 44904	51
10	9. 61764	0. 41461	9. 62657	0. 42322	9. 63534	0. 43185	9. 64396	0. 44051	9. 65242	0. 44918	50
11	. 61779	. 41475	. 62671	. 42336	. 63548	. 43200	. 64410	. 44065	. 65256	. 44933	49
12	. 61794	. 41490	. 62686	. 42351	. 63563	. 43214	. 64424	. 44080	. 65270	. 44947	48
13	. 61809	. 41504	. 62701	. 42365	. 63577	. 43229	. 64438	. 44094	. 65284	. 44962	47
14	. 61824	. 41518	. 62716	. 42379	. 63592	. 43243	. 64452	. 44109	. 65298	. 44976	46
15	9. 61839	0. 41533	9. 62730	0. 42394	9. 63606	0. 43257	9. 64467	0. 44123	9. 65312	0. 44991	45
16	. 61854	. 41547	. 62745	. 42408	. 63621	. 43272	. 64481	. 44138	. 65326	. 45005	44
17	. 61869	. 41561	. 62760	. 42423	. 63635	. 43286	. 64495	. 44152	. 65340	. 45020	43
18	. 61884	. 41576	. 62774	. 42437	. 63649	. 43301	. 64509	. 44166	. 65354	. 45034	42
19	. 61899	. 41590	. 62789	. 42451	. 63664	. 43315	. 64523	. 44181	. 65368	. 45048	41
20	9. 61914	0. 41604	9. 62804	0. 42466	9. 63678	0. 43330	9. 64538	0. 44195	9. 65382	0. 45063	40
21	. 61929	. 41619	. 62819	. 42480	. 63693	. 43344	. 64552	. 44210	. 65396	. 45077	39
22	. 61944	. 41633	. 62833	. 42494	. 63707	. 43358	. 64566	. 44224	. 65410	. 45092	38
23	. 61959	. 41647	. 62848	. 42509	. 63722	. 43373	. 64580	. 44239	. 65424	. 45106	37
24	. 61974	. 41662	. 62863	. 42523	. 63736	. 43387	. 64594	. 44253	. 65438	. 45121	36
25	9. 61989	0. 41676	9. 62877	0. 42538	9. 63751	0. 43402	9. 64609	0. 44268	9. 65452	0. 45135	35
26	. 62003	. 41690	. 62892	. 42552	. 63765	. 43416	. 64623	. 44282	. 65466	. 45150	34
27	. 62018	. 41705	. 62907	. 42566	. 63779	. 43430	. 64637	. 44296	. 65480	. 45164	33
28	. 62033	. 41719	. 62921	. 42581	. 63794	. 43445	. 64651	. 44311	. 65493	. 45179	32
29	. 62048	. 41733	. 62936	. 42595	. 63808	. 43459	. 64665	. 44325	. 65507	. 45193	31
30	9. 62063	0. 41748	9. 62951	0. 42610	9. 63823	0. 43474	9. 64679	0. 44340	9. 65521	0. 45208	30
31	. 62078	. 41762	. 62965	. 42624	. 63837	. 43488	. 64694	. 44354	. 65535	. 45222	29
32	. 62093	. 41776	. 62980	. 42638	. 63851	. 43503	. 64708	. 44369	. 65549	. 45237	28
33	. 62108	. 41791	. 62995	. 42653	. 63866	. 43517	. 64722	. 44383	. 65563	. 45251	27
34	. 62123	. 41805	. 63009	. 42667	. 63880	. 43531	. 64736	. 44398	. 65577	. 45266	26
35	9. 62138	0. 41819	9. 63024	0. 42681	9. 63895	0. 43546	9. 64750	0. 44412	9. 65591	0. 45280	25
36	. 62153	. 41834	. 63039	. 42696	. 63909	. 43560	. 64764	. 44427	. 65605	. 45295	24
37	. 62168	. 41848	. 63053	. 42710	. 63923	. 43575	. 64778	. 44441	. 65619	. 45309	23
38	. 62182	. 41862	. 63068	. 42725	. 63938	. 43589	. 64793	. 44455	. 65632	. 45324	22
39	. 62197	. 41877	. 63082	. 42739	. 63952	. 43603	. 64807	. 44470	. 65646	. 45338	21
40	9. 62212	0. 41891	9. 63097	0. 42753	9. 63966	0. 43618	9. 64821	0. 44484	9. 65660	0. 45353	20
41	. 62227	. 41905	. 63112	. 42768	. 63981	. 43632	. 64835	. 44499	. 65674	. 45367	19
42	. 62242	. 41920	. 63126	. 42782	. 63995	. 43647	. 64849	. 44513	. 65688	. 45381	18
43	. 62257	. 41934	. 63141	. 42797	. 64010	. 43661	. 64863	. 44528	. 65702	. 45396	17
44	. 62272	. 41949	. 63156	. 42811	. 64024	. 43676	. 64877	. 44542	. 65716	. 45410	16
45	9. 62287	0. 41963	9. 63170	0. 42825	9. 64038	0. 43690	9. 64891	0. 44557	9. 65729	0. 45425	15
46	. 62301	. 41977	. 63185	. 42840	. 64053	. 43704	. 64905	. 44571	. 65743	. 45439	14
47	. 62316	. 41992	. 63199	. 42854	. 64067	. 43719	. 64919	. 44586	. 65757	. 45454	13
48	. 62331	. 42006	. 63214	. 42869	. 64081	. 43733	. 64934	. 44600	. 65771	. 45468	12
49	. 62346	. 42020	. 63228	. 42883	. 64096	. 43748	. 64948	. 44614	. 65785	. 45483	11
50	9. 62361	0. 42035	9. 63243	0. 42897	9. 64110	0. 43762	9. 64962	0. 44629	9. 65799	0. 45497	10
51	. 62376	. 42049	. 63258	. 42912	. 64124	. 43777	. 64976	. 44643	. 65812	. 45512	9
52	. 62390	. 42063	. 63272	. 42926	. 64139	. 43791	. 64990	. 44658	. 65826	. 45526	8
53	. 62405	. 42078	. 63287	. 42941	. 64153	. 43805	. 65004	. 44672	. 65840	. 45541	7
54	. 62420	. 42092	. 63301	. 42955	. 64167	. 43820	. 65018	. 44687	. 65854	. 45555	6
55	9. 62435	0. 42106	9. 63316	0. 42969	9. 64181	0. 43834	9. 65032	0. 44701	9. 65868	0. 45570	5
56	. 62450	. 42121	. 63330	. 42984	. 64196	. 43849	. 65046	. 44716	. 65881	. 45584	4
57	. 62464	. 42135	. 63345	. 42998	. 64210	. 43863	. 65060	. 44730	. 65895	. 45599	3
58	. 62479	. 42150	. 63360	. 43013	. 64224	. 43878	. 65074	. 44745	. 65909	. 45613	2
59	. 62494	. 42164	. 63374	. 43027	. 64239	. 43892	. 65088	. 44759	. 65923	. 45628	1
60	9. 62509	0. 42178	9. 63389	0. 43041	9. 64253	0. 43907	9. 65102	0. 44774	9. 65937	0. 45642	0
	279°		278°		277°		276°		275°		

2

Haversines

	85°		86°		87°		88°		89°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9. 65937	0. 45642	9. 66757	0. 46512	9. 67562	0. 47383	9. 68354	0. 48255	9. 69132	0. 49127	60
1	. 65950	. 45657	. 66770	. 46527	. 67576	. 47398	. 68367	. 48270	. 69145	. 49142	59
2	. 65964	. 45671	. 66784	. 46541	. 67589	. 47412	. 68380	. 48284	. 69158	. 49156	58
3	. 65978	. 45686	. 66797	. 46556	. 67602	. 47427	. 68393	. 48299	. 69171	. 49171	57
4	. 65992	. 45700	. 66811	. 46570	. 67616	. 47441	. 68407	. 48313	. 69184	. 49186	56
5	9. 66006	0. 45715	9. 66824	0. 46585	9. 67629	0. 47456	9. 68420	0. 48328	9. 69197	0. 49200	55
6	. 66019	. 45729	. 66838	. 46599	. 67642	. 47470	. 68433	. 48342	. 69209	. 49215	54
7	. 66033	. 45744	. 66851	. 46614	. 67656	. 47485	. 68446	. 48357	. 69222	. 49229	53
8	. 66047	. 45758	. 66865	. 46628	. 67669	. 47499	. 68459	. 48371	. 69235	. 49244	52
9	. 66061	. 45773	. 66878	. 46643	. 67682	. 47514	. 68472	. 48386	. 69248	. 49258	51
10	9. 66074	0. 45787	9. 66892	0. 46657	9. 67695	0. 47528	9. 68485	0. 48400	9. 69261	0. 49273	50
11	. 66088	. 45802	. 66905	. 46672	. 67709	. 47543	. 68498	. 48415	. 69274	. 49287	49
12	. 66102	. 45816	. 66919	. 46686	. 67722	. 47558	. 68511	. 48429	. 69286	. 49302	48
13	. 66116	. 45831	. 66932	. 46701	. 67735	. 47572	. 68524	. 48444	. 69299	. 49316	47
14	. 66129	. 45845	. 66946	. 46715	. 67748	. 47587	. 68537	. 48459	. 69312	. 49331	46
15	9. 66143	0. 45860	9. 66959	0. 46730	9. 67762	0. 47601	9. 68550	0. 48473	9. 69325	0. 49346	45
16	. 66157	. 45874	. 66973	. 46744	. 67775	. 47616	. 68563	. 48488	. 69338	. 49360	44
17	. 66170	. 45889	. 66986	. 46759	. 67788	. 47630	. 68576	. 48502	. 69350	. 49375	43
18	. 66184	. 45903	. 67000	. 46773	. 67801	. 47645	. 68589	. 48517	. 69363	. 49389	42
19	. 66198	. 45918	. 67013	. 46788	. 67815	. 47659	. 68602	. 48531	. 69376	. 49404	41
20	9. 66212	0. 45932	9. 67027	0. 46802	9. 67828	0. 47674	9. 68615	0. 48546	9. 69389	0. 49418	40
21	. 66225	. 45947	. 67040	. 46817	. 67841	. 47688	. 68628	. 48560	. 69402	. 49433	39
22	. 66239	. 45961	. 67054	. 46831	. 67854	. 47703	. 68641	. 48575	. 69414	. 49447	38
23	. 66253	. 45976	. 67067	. 46846	. 67868	. 47717	. 68654	. 48589	. 69427	. 49462	37
24	. 66266	. 45990	. 67081	. 46860	. 67881	. 47732	. 68667	. 48604	. 69440	. 49476	36
25	9. 66280	0. 46005	9. 67094	0. 46875	9. 67894	0. 47746	9. 68680	0. 48618	9. 69453	0. 49491	35
26	. 66294	. 46019	. 67108	. 46890	. 67907	. 47761	. 68693	. 48633	. 69465	. 49505	34
27	. 66307	. 46034	. 67121	. 46904	. 67920	. 47775	. 68706	. 48648	. 69478	. 49520	33
28	. 66321	. 46048	. 67134	. 46919	. 67934	. 47790	. 68719	. 48662	. 69491	. 49535	32
29	. 66335	. 46063	. 67148	. 46933	. 67947	. 47804	. 68732	. 48677	. 69504	. 49549	31
30	9. 66348	0. 46077	9. 67161	0. 46948	9. 67960	0. 47819	9. 68745	0. 48691	9. 69516	0. 49564	30
31	. 66362	. 46092	. 67175	. 46962	. 67973	. 47834	. 68758	. 48706	. 69529	. 49578	29
32	. 66376	. 46106	. 67188	. 46977	. 67986	. 47848	. 68771	. 48720	. 69542	. 49593	28
33	. 66389	. 46121	. 67202	. 46991	. 68000	. 47863	. 68784	. 48735	. 69555	. 49607	27
34	. 66403	. 46135	. 67215	. 47006	. 68013	. 47877	. 68797	. 48749	. 69567	. 49622	26
35	9. 66417	0. 46150	9. 67228	0. 47020	9. 68026	0. 47892	9. 68810	0. 48764	9. 69580	0. 49636	25
36	. 66430	. 46164	. 67242	. 47035	. 68039	. 47906	. 68823	. 48778	. 69593	. 49651	24
37	. 66444	. 46179	. 67255	. 47049	. 68052	. 47921	. 68836	. 48793	. 69605	. 49665	23
38	. 66458	. 46193	. 67269	. 47064	. 68066	. 47935	. 68849	. 48807	. 69618	. 49680	22
39	. 66471	. 46208	. 67282	. 47078	. 68079	. 47950	. 68862	. 48822	. 69631	. 49695	21
40	9. 66485	0. 46222	9. 67295	0. 47093	9. 68092	0. 47964	9. 68875	0. 48837	9. 69644	0. 49709	20
41	. 66499	. 46237	. 67309	. 47107	. 68105	. 47979	. 68887	. 48851	. 69656	. 49724	19
42	. 66512	. 46251	. 67322	. 47122	. 68118	. 47993	. 68900	. 48866	. 69669	. 49738	18
43	. 66526	. 46266	. 67336	. 47136	. 68131	. 48008	. 68913	. 48880	. 69682	. 49753	17
44	. 66539	. 46280	. 67349	. 47151	. 68144	. 48022	. 68926	. 48895	. 69694	. 49767	16
45	9. 66553	0. 46295	9. 67362	0. 47165	9. 68158	0. 48037	9. 68939	0. 48909	9. 69707	0. 49782	15
46	. 66567	. 46309	. 67376	. 47180	. 68171	. 48052	. 68952	. 48924	. 69720	. 49796	14
47	. 66580	. 46324	. 67389	. 47194	. 68184	. 48066	. 68965	. 48938	. 69732	. 49811	13
48	. 66594	. 46338	. 67402	. 47209	. 68197	. 48081	. 68978	. 48953	. 69745	. 49825	12
49	. 66607	. 46353	. 67416	. 47223	. 68210	. 48095	. 68991	. 48967	. 69758	. 49840	11
50	9. 66621	0. 46367	9. 67429	0. 47238	9. 68223	0. 48110	9. 69004	0. 48982	9. 69770	0. 49855	10
51	. 66635	. 46382	. 67443	. 47252	. 68236	. 48124	. 69017	. 48997	. 69783	. 49869	9
52	. 66648	. 46396	. 67456	. 47267	. 68249	. 48139	. 69029	. 49011	. 69796	. 49884	8
53	. 66662	. 46411	. 67469	. 47282	. 68263	. 48153	. 69042	. 49026	. 69808	. 49898	7
54	. 66675	. 46425	. 67483	. 47296	. 68276	. 48168	. 69055	. 49040	. 69821	. 49913	6
55	9. 66689	0. 46440	9. 67496	0. 47311	9. 68289	0. 48182	9. 69068	0. 49055	9. 69834	0. 49927	5
56	. 66702	. 46454	. 67509	. 47325	. 68302	. 48197	. 69081	. 49069	. 69846	. 49942	4
57	. 66716	. 46469	. 67522	. 47340	. 68315	. 48211	. 69094	. 49084	. 69859	. 49956	3
58	. 66730	. 46483	. 67536	. 47354	. 68328	. 48226	. 69107	. 49098	. 69872	. 49971	2
59	. 66743	. 46498	. 67549	. 47369	. 68341	. 48240	. 69120	. 49113	. 69884	. 49985	1
60	9. 66757	0. 46512	9. 67562	0. 47383	9. 68354	0. 48255	9. 69132	0. 49127	9. 69897	0. 50000	0
	274°		273°		272°		271°		270°		

Haversines

	90°		91°		92°		93°		94°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9. 69897	0. 50000	9. 70648	0. 50872	9. 71387	0. 51745	9. 72112	0. 52617	9. 72825	0. 53488	60
1	69910	50015	70661	50887	71399	51760	72124	52631	72837	53502	59
2	69922	50029	70673	50902	71411	51774	72136	52646	72849	53517	58
3	69935	50044	70686	50916	71423	51789	72148	52660	72861	53531	57
4	69948	50058	70698	50931	71436	51803	72160	52675	72873	53546	56
5	9. 69960	0. 50073	9. 70710	0. 50945	9. 71448	0. 51818	9. 72172	0. 52689	9. 72884	0. 53560	55
6	69973	50087	70723	50960	71460	51832	72184	52704	72896	53575	54
7	69985	50102	70735	50974	71472	51847	72196	52718	72908	53589	53
8	69998	50116	70748	50989	71484	51861	72208	52733	72920	53604	52
9	70011	50131	70760	51003	71496	51876	72220	52748	72931	53618	51
10	9. 70023	0. 50145	9. 70772	0. 51018	9. 71509	0. 51890	9. 72232	0. 52762	9. 72943	0. 53633	50
11	70036	50160	70785	51033	71521	51905	72244	52777	72955	53647	49
12	70048	50175	70797	51047	71533	51919	72256	52791	72967	53662	48
13	70061	50189	70809	51062	71545	51934	72268	52806	72978	53676	47
14	70074	50204	70822	51076	71557	51948	72280	52820	72990	53691	46
15	9. 70086	0. 50218	9. 70834	0. 51091	9. 71569	0. 51963	9. 72292	0. 52835	9. 73002	0. 53705	45
16	70099	50233	70847	51105	71582	51978	72304	52849	73014	53720	44
17	70111	50247	70859	51120	71594	51992	72316	52864	73025	53734	43
18	70124	50262	70871	51134	71606	52007	72328	52878	73037	53749	42
19	70136	50276	70884	51149	71618	52021	72340	52893	73049	53763	41
20	9. 70149	0. 50291	9. 70896	0. 51163	9. 71630	0. 52036	9. 72352	0. 52907	9. 73060	0. 53778	40
21	70161	50305	70908	51178	71642	52050	72363	52922	73072	53792	39
22	70174	50320	70921	51193	71654	52065	72375	52936	73084	53807	38
23	70187	50335	70933	51207	71666	52079	72387	52951	73096	53821	37
24	70199	50349	70945	51222	71679	52094	72399	52965	73107	53836	36
25	9. 70212	0. 50364	9. 70958	0. 51236	9. 71691	0. 52108	9. 72411	0. 52980	9. 73119	0. 53850	35
26	70224	50378	70970	51251	71703	52123	72423	52994	73131	53865	34
27	70237	50393	70982	51265	71715	52137	72435	53009	73142	53879	33
28	70249	50407	70995	51280	71727	52152	72447	53023	73154	53894	32
29	70262	50422	71007	51294	71739	52166	72459	53038	73166	53908	31
30	9. 70274	0. 50436	9. 71019	0. 51309	9. 71751	0. 52181	9. 72471	0. 53052	9. 73177	0. 53923	30
31	70287	50451	71032	51323	71763	52195	72482	53067	73189	53937	29
32	70299	50465	71044	51338	71775	52210	72494	53081	73201	53952	28
33	70312	50480	71056	51352	71787	52225	72506	53096	73212	53966	27
34	70324	50495	71068	51367	71800	52239	72518	53110	73224	53981	26
35	9. 70337	0. 50509	9. 71081	0. 51382	9. 71812	0. 52254	9. 72530	0. 53125	9. 73236	0. 53995	25
36	70349	50524	71093	51396	71824	52268	72542	53140	73247	54010	24
37	70362	50538	71105	51411	71836	52282	72554	53154	73259	54024	23
38	70374	50553	71118	51425	71848	52297	72565	53169	73271	54039	22
39	70387	50567	71130	51440	71860	52312	72577	53183	73282	54053	21
40	9. 70399	0. 50582	9. 71142	0. 51454	9. 71872	0. 52326	9. 72588	0. 53198	9. 73294	0. 54068	20
41	70412	50596	71154	51469	71884	52341	72601	53212	73306	54082	19
42	70424	50611	71167	51483	71896	52355	72613	53227	73317	54097	18
43	70437	50625	71179	51498	71908	52370	72625	53241	73329	54111	17
44	70449	50640	71191	51512	71920	52384	72637	53256	73341	54126	16
45	9. 70462	0. 50654	9. 71203	0. 51527	9. 71932	0. 52399	9. 72648	0. 53270	9. 73352	0. 54140	15
46	70474	50669	71216	51541	71944	52413	72660	53285	73364	54155	14
47	70487	50684	71228	51556	71956	52428	72672	53299	73375	54169	13
48	70499	50698	71240	51571	71968	52442	72684	53314	73387	54184	12
49	70512	50713	71252	51585	71980	52457	72696	53328	73399	54198	11
50	9. 70524	0. 50727	9. 71265	0. 51600	9. 71992	0. 52472	9. 72708	0. 53343	9. 73410	0. 54213	10
51	70537	50742	71277	51614	72004	52486	72719	53357	73422	54227	9
52	70549	50756	71289	51629	72016	52501	72731	53372	73433	54242	8
53	70561	50771	71301	51643	72028	52515	72743	53386	73445	54256	7
54	70574	50785	71314	51658	72040	52530	72755	53401	73457	54271	6
55	9. 70586	0. 50800	9. 71326	0. 51672	9. 72052	0. 52544	9. 72767	0. 53415	9. 73468	0. 54285	5
56	70599	50814	71338	51687	72064	52559	72778	53430	73480	54300	4
57	70611	50829	71350	51701	72076	52573	72790	53444	73491	54314	3
58	70624	50844	71362	51716	72088	52588	72802	53459	73503	54329	2
59	70636	50858	71375	51730	72100	52602	72814	53473	73515	54343	1
60	9. 70648	0. 50873	9. 71387	0. 51745	9. 72112	0. 52617	9. 72825	0. 53488	9. 73526	0. 54358	0
	269°		268°		267°		266°		265°		

2

Haversines

	95°		96°		97°		98°		99°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.73526	0.54358	9.74215	0.55226	9.74891	0.56093	9.75556	0.56959	9.76209	0.57822	60
1	.73538	.54372	.74226	.55241	.74902	.56108	.75567	.56973	.76220	.57836	59
2	.73549	.54387	.74237	.55255	.74914	.56122	.75578	.56987	.76231	.57850	58
3	.73561	.54401	.74249	.55270	.74925	.56137	.75589	.57002	.76241	.57865	57
4	.73572	.54416	.74260	.55284	.74936	.56151	.75600	.57016	.76252	.57879	56
5	9.73584	0.54430	9.74272	0.55299	9.74947	0.56166	9.75611	0.57031	9.76263	0.57894	55
6	.73596	.54445	.74283	.55313	.74958	.56180	.75622	.57045	.76274	.57908	54
7	.73607	.54459	.74294	.55328	.74969	.56195	.75633	.57059	.76285	.57922	53
8	.73619	.54474	.74306	.55342	.74981	.56209	.75644	.57074	.76296	.57937	52
9	.73630	.54488	.74317	.55357	.74992	.56223	.75655	.57088	.76306	.57951	51
10	9.73642	0.54503	9.74328	0.55371	9.75003	0.56238	9.75666	0.57103	9.76317	0.57965	50
11	.73653	.54517	.74340	.55386	.75014	.56252	.75677	.57117	.76328	.57980	49
12	.73665	.54532	.74351	.55400	.75025	.56267	.75688	.57131	.76338	.57994	48
13	.73676	.54546	.74362	.55414	.75036	.56281	.75698	.57146	.76349	.58008	47
14	.73688	.54561	.74374	.55429	.75047	.56296	.75709	.57160	.76360	.58023	46
15	9.73699	0.54575	9.74385	0.55443	9.75059	0.56310	9.75720	0.57175	9.76371	0.58037	45
16	.73711	.54590	.74396	.55458	.75070	.56324	.75731	.57189	.76381	.58051	44
17	.73722	.54604	.74408	.55472	.75081	.56339	.75742	.57203	.76392	.58066	43
18	.73734	.54619	.74419	.55487	.75092	.56353	.75753	.57218	.76403	.58080	42
19	.73746	.54633	.74430	.55501	.75103	.56368	.75764	.57232	.76414	.58095	41
20	9.73757	0.54647	9.74442	0.55516	9.75114	0.56382	9.75775	0.57247	9.76424	0.58109	40
21	.73769	.54662	.74453	.55530	.75125	.56397	.75786	.57261	.76435	.58123	39
22	.73780	.54676	.74464	.55545	.75136	.56411	.75797	.57275	.76446	.58138	38
23	.73792	.54691	.74475	.55559	.75147	.56425	.75808	.57290	.76456	.58152	37
24	.73803	.54705	.74487	.55573	.75159	.56440	.75819	.57304	.76467	.58166	36
25	9.73815	0.54720	9.74498	0.55588	9.75170	0.56454	9.75830	0.57319	9.76478	0.58181	35
26	.73826	.54734	.74509	.55602	.75181	.56469	.75840	.57333	.76489	.58195	34
27	.73838	.54749	.74521	.55617	.75192	.56483	.75851	.57347	.76499	.58209	33
28	.73849	.54763	.74532	.55631	.75203	.56497	.75862	.57362	.76510	.58224	32
29	.73860	.54778	.74543	.55646	.75214	.56512	.75873	.57376	.76521	.58238	31
30	9.73872	0.54792	9.74554	0.55660	9.75225	0.56526	9.75884	0.57390	9.76531	0.58252	30
31	.73883	.54807	.74566	.55675	.75236	.56541	.75895	.57405	.76542	.58267	29
32	.73895	.54821	.74577	.55689	.75247	.56555	.75906	.57419	.76553	.58281	28
33	.73906	.54836	.74588	.55704	.75258	.56570	.75917	.57434	.76563	.58295	27
34	.73918	.54850	.74600	.55718	.75269	.56584	.75927	.57448	.76574	.58310	26
35	9.73929	0.54865	9.74611	0.55732	9.75280	0.56598	9.75938	0.57462	9.76585	0.58324	25
36	.73941	.54879	.74622	.55747	.75291	.56613	.75949	.57477	.76595	.58338	24
37	.73952	.54894	.74633	.55761	.75303	.56627	.75960	.57491	.76606	.58353	23
38	.73964	.54908	.74645	.55776	.75314	.56642	.75971	.57506	.76617	.58367	22
39	.73975	.54923	.74656	.55790	.75325	.56656	.75982	.57520	.76627	.58381	21
40	9.73987	0.54937	9.74667	0.55805	9.75336	0.56670	9.75993	0.57534	9.76638	0.58396	20
41	.73998	.54952	.74678	.55819	.75347	.56685	.76004	.57549	.76649	.58410	19
42	.74009	.54966	.74690	.55834	.75358	.56699	.76014	.57563	.76659	.58424	18
43	.74021	.54980	.74701	.55848	.75369	.56714	.76025	.57577	.76670	.58439	17
44	.74032	.54995	.74712	.55862	.75380	.56728	.76036	.57592	.76681	.58453	16
45	9.74044	0.55009	9.74723	0.55877	9.75391	0.56743	9.76047	0.57606	9.76691	0.58467	15
46	.74055	.55024	.74734	.55891	.75402	.56757	.76058	.57621	.76702	.58482	14
47	.74067	.55038	.74746	.55906	.75413	.56771	.76069	.57635	.76713	.58496	13
48	.74078	.55053	.74757	.55920	.75424	.56786	.76079	.57649	.76723	.58510	12
49	.74089	.55067	.74768	.55935	.75435	.56800	.76090	.57664	.76734	.58525	11
50	9.74101	0.55082	9.74779	0.55949	9.75446	0.56815	9.76101	0.57678	9.76745	0.58539	10
51	.74112	.55096	.74791	.55964	.75457	.56829	.76112	.57692	.76755	.58553	9
52	.74124	.55111	.74802	.55978	.75468	.56843	.76123	.57707	.76766	.58568	8
53	.74135	.55125	.74813	.55992	.75479	.56858	.76134	.57721	.76777	.58582	7
54	.74146	.55140	.74824	.56007	.75490	.56872	.76144	.57736	.76787	.58596	6
55	9.74158	0.55154	9.74835	0.56021	9.75501	0.56887	9.76155	0.57750	9.76798	0.58611	5
56	.74169	.55169	.74846	.56036	.75512	.56901	.76166	.57764	.76808	.58625	4
57	.74181	.55183	.74858	.56050	.75523	.56915	.76177	.57779	.76819	.58639	3
58	.74192	.55197	.74869	.56065	.75534	.56930	.76188	.57793	.76830	.58654	2
59	.74203	.55212	.74880	.56079	.75545	.56944	.76198	.57807	.76840	.58668	1
60	9.74215	0.55226	9.74891	0.56093	9.75556	0.56959	9.76209	0.57822	9.76851	0.58682	0
	264°		263°		262°		261°		260°		

2

Haversines

	100°		101°		102°		103°		104°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.76851	0.58682	9.77481	0.59540	9.78101	0.60396	9.78709	0.61248	9.79306	0.62096	60
1	76861	58697	77492	59555	78111	60410	78719	61262	79316	62110	59
2	76872	58711	77502	59569	78121	60424	78729	61276	79326	62124	58
3	76883	58725	77512	59583	78131	60438	78739	61290	79336	62138	57
4	76893	58740	77523	59598	78141	60452	78749	61304	79346	62153	56
5	9.76904	0.58754	9.77533	0.59612	9.78152	0.60467	9.78759	0.61318	9.79356	0.62167	55
6	76914	58768	77544	59626	78162	60481	78769	61333	79366	62181	54
7	76925	58783	77554	59640	78172	60495	78779	61347	79376	62195	53
8	76936	58797	77564	59655	78182	60509	78789	61361	79385	62209	52
9	76946	58811	77575	59669	78192	60524	78799	61375	79395	62223	51
10	9.76957	0.58826	9.77585	0.59683	9.78203	0.60538	9.78809	0.61389	9.79405	0.62237	50
11	76967	58840	77596	59697	78213	60552	78819	61403	79415	62251	49
12	76978	58854	77606	59712	78223	60566	78829	61418	79425	62265	48
13	76988	58869	77616	59726	78233	60580	78839	61432	79434	62279	47
14	76999	58883	77627	59740	78243	60595	78849	61446	79444	62294	46
15	9.77009	0.58897	9.77637	0.59755	9.78254	0.60609	9.78859	0.61460	9.79454	0.62308	45
16	77020	58911	77647	59769	78264	60623	78869	61474	79464	62322	44
17	77031	58926	77658	59783	78274	60637	78879	61488	79474	62336	43
18	77041	58940	77668	59797	78284	60652	78889	61502	79484	62350	42
19	77052	58954	77679	59812	78294	60666	78899	61517	79493	62364	41
20	9.77062	0.58969	9.77689	0.59826	9.78305	0.60680	9.78909	0.61531	9.79503	0.62378	40
21	77073	58983	77699	59840	78315	60694	78919	61545	79513	62392	39
22	77083	58997	77710	59854	78325	60708	78929	61559	79523	62406	38
23	77094	59012	77720	59869	78335	60723	78939	61573	79533	62420	37
24	77104	59026	77730	59883	78345	60737	78949	61587	79542	62434	36
25	9.77115	0.59040	9.77741	0.59897	9.78355	0.60751	9.78959	0.61602	9.79552	0.62449	35
26	77125	59055	77751	59911	78365	60765	78969	61616	79562	62463	34
27	77136	59069	77761	59926	78376	60779	78979	61630	79572	62477	33
28	77146	59083	77772	59940	78386	60794	78989	61644	79582	62491	32
29	77157	59097	77782	59954	78396	60808	78999	61658	79591	62505	31
30	9.77167	0.59112	9.77792	0.59968	9.78406	0.60822	9.79009	0.61672	9.79601	0.62519	30
31	77178	59126	77803	59983	78416	60836	79019	61686	79611	62533	29
32	77188	59140	77813	59997	78426	60850	79029	61701	79621	62547	28
33	77199	59155	77823	60011	78436	60865	79039	61715	79631	62561	27
34	77209	59169	77834	60025	78447	60879	79049	61729	79640	62575	26
35	9.77220	0.59183	9.77844	0.60040	9.78457	0.60893	9.79059	0.61743	9.79650	0.62589	25
36	77230	59198	77854	60054	78467	60907	79069	61757	79660	62603	24
37	77241	59212	77864	60068	78477	60921	79079	61771	79670	62618	23
38	77251	59226	77875	60082	78487	60936	79089	61785	79679	62632	22
39	77262	59240	77885	60097	78497	60950	79099	61800	79689	62646	21
40	9.77272	0.59255	9.77895	0.60111	9.78507	0.60964	9.79108	0.61814	9.79699	0.62660	20
41	77283	59269	77906	60125	78517	60978	79118	61828	79709	62674	19
42	77293	59283	77916	60139	78528	60992	79128	61842	79718	62688	18
43	77304	59298	77926	60154	78538	61006	79138	61856	79728	62702	17
44	77314	59312	77936	60168	78548	61021	79148	61870	79738	62716	16
45	9.77325	0.59326	9.77947	0.60182	9.78558	0.61035	9.79158	0.61884	9.79748	0.62730	15
46	77335	59340	77957	60196	78568	61049	79168	61898	79757	62744	14
47	77346	59355	77967	60211	78578	61063	79178	61913	79767	62758	13
48	77356	59369	77978	60225	78588	61077	79188	61927	79777	62772	12
49	77366	59383	77988	60239	78598	61092	79198	61941	79787	62786	11
50	9.77377	0.59398	9.77998	0.60253	9.78608	0.61106	9.79208	0.61955	9.79796	0.62800	10
51	77387	59412	78008	60268	78618	61120	79217	61969	79806	62814	9
52	77398	59426	78019	60282	78628	61134	79227	61983	79816	62829	8
53	77408	59440	78029	60296	78638	61148	79237	61997	79825	62843	7
54	77419	59455	78039	60310	78649	61163	79247	62011	79835	62857	6
55	9.77429	0.59469	9.78049	0.60324	9.78659	0.61177	9.79257	0.62026	9.79845	0.62871	5
56	77440	59483	78060	60339	78669	61191	79267	62040	79855	62885	4
57	77450	59498	78070	60353	78679	61205	79277	62054	79864	62899	3
58	77460	59512	78080	60367	78689	61219	79287	62068	79874	62913	2
59	77471	59526	78090	60381	78699	61233	79297	62082	79884	62927	1
60	9.77481	0.59540	9.78101	0.60396	9.78709	0.61248	9.79306	0.62096	9.79893	0.62941	0
	259°		258°		257°		256°		255°		

2

Havermine

	105°		106°		107°		108°		109°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.79893	0.62941	9.80470	0.63782	9.81036	0.64619	9.81592	0.65451	9.82137	0.66278	60
1	.79903	.62955	.80479	.63796	.81045	.64632	.81601	.65465	.82146	.66292	59
2	.79913	.62969	.80489	.63810	.81054	.64646	.81610	.65479	.82155	.66306	58
3	.79922	.62983	.80498	.63824	.81064	.64660	.81619	.65492	.82164	.66320	57
4	.79932	.62997	.80508	.63838	.81073	.64674	.81628	.65506	.82173	.66333	56
5	9.79942	0.63011	9.80517	0.63852	9.81082	0.64688	9.81637	0.65520	9.82182	0.66347	55
6	.79951	.63025	.80527	.63866	.81092	.64702	.81647	.65534	.82191	.66361	54
7	.79961	.63039	.80536	.63880	.81101	.64716	.81656	.65548	.82200	.66375	53
8	.79971	.63053	.80546	.63894	.81110	.64730	.81665	.65561	.82209	.66388	52
9	.79980	.63067	.80555	.63908	.81120	.64744	.81674	.65575	.82218	.66402	51
10	9.79990	0.63081	9.80565	0.63922	9.81129	0.64758	9.81683	0.65589	9.82227	0.66416	50
11	.80000	.63095	.80574	.63936	.81138	.64772	.81692	.65603	.82236	.66430	49
12	.80009	.63109	.80584	.63950	.81148	.64785	.81701	.65617	.82245	.66443	48
13	.80019	.63123	.80593	.63964	.81157	.64799	.81711	.65631	.82254	.66457	47
14	.80029	.63138	.80603	.63977	.81166	.64813	.81720	.65644	.82263	.66471	46
15	9.80038	0.63152	9.80612	0.63991	9.81176	0.64827	9.81729	0.65658	9.82272	0.66485	45
16	.80048	.63166	.80622	.64005	.81185	.64841	.81738	.65672	.82281	.66498	44
17	.80058	.63180	.80631	.64019	.81194	.64855	.81747	.65686	.82290	.66512	43
18	.80067	.63194	.80641	.64033	.81204	.64869	.81756	.65700	.82299	.66526	42
19	.80077	.63208	.80650	.64047	.81213	.64883	.81765	.65713	.82308	.66539	41
20	9.80087	0.63222	9.80660	0.64061	9.81222	0.64897	9.81775	0.65727	9.82317	0.66553	40
21	.80096	.63236	.80669	.64075	.81231	.64910	.81784	.65741	.82326	.66567	39
22	.80106	.63250	.80678	.64089	.81241	.64924	.81793	.65755	.82335	.66581	38
23	.80116	.63264	.80688	.64103	.81250	.64938	.81802	.65769	.82344	.66594	37
24	.80125	.63278	.80697	.64117	.81259	.64952	.81811	.65782	.82353	.66608	36
25	9.80135	0.63292	9.80707	0.64131	9.81269	0.64966	9.81820	0.65796	9.82362	0.66622	35
26	.80144	.63306	.80716	.64145	.81278	.64980	.81829	.65810	.82371	.66635	34
27	.80154	.63320	.80726	.64159	.81287	.64994	.81838	.65824	.82380	.66649	33
28	.80164	.63334	.80735	.64173	.81296	.65008	.81847	.65838	.82388	.66663	32
29	.80173	.63348	.80745	.64187	.81306	.65021	.81857	.65851	.82397	.66677	31
30	9.80183	0.63362	9.80754	0.64201	9.81315	0.65035	9.81866	0.65865	9.82406	0.66690	30
31	.80192	.63376	.80763	.64215	.81324	.65049	.81875	.65879	.82415	.66704	29
32	.80202	.63390	.80773	.64229	.81333	.65063	.81884	.65893	.82424	.66718	28
33	.80212	.63404	.80782	.64243	.81343	.65077	.81893	.65907	.82433	.66731	27
34	.80221	.63418	.80792	.64257	.81352	.65091	.81902	.65920	.82442	.66745	26
35	9.80231	0.63432	9.80801	0.64270	9.81361	0.65105	9.81911	0.65934	9.82451	0.66759	25
36	.80240	.63446	.80811	.64284	.81370	.65118	.81920	.65948	.82460	.66773	24
37	.80250	.63460	.80820	.64298	.81380	.65132	.81929	.65962	.82469	.66786	23
38	.80260	.63474	.80829	.64312	.81389	.65146	.81938	.65976	.82478	.66800	22
39	.80269	.63488	.80839	.64326	.81398	.65160	.81947	.65989	.82487	.66814	21
40	9.80279	0.63502	9.80848	0.64340	9.81407	0.65174	9.81956	0.66003	9.82495	0.66827	20
41	.80288	.63516	.80858	.64354	.81417	.65188	.81965	.66017	.82504	.66841	19
42	.80298	.63530	.80867	.64368	.81426	.65202	.81975	.66031	.82513	.66855	18
43	.80307	.63544	.80876	.64382	.81435	.65216	.81984	.66044	.82522	.66868	17
44	.80317	.63558	.80886	.64396	.81444	.65229	.81993	.66058	.82531	.66882	16
45	9.80327	0.63572	9.80895	0.64410	9.81454	0.65243	9.82002	0.66072	9.82540	0.66896	15
46	.80336	.63586	.80905	.64424	.81463	.65257	.82011	.66086	.82549	.66910	14
47	.80346	.63600	.80914	.64438	.81472	.65271	.82020	.66100	.82558	.66923	13
48	.80355	.63614	.80923	.64452	.81481	.65285	.82029	.66113	.82567	.66937	12
49	.80365	.63628	.80933	.64466	.81490	.65299	.82038	.66127	.82575	.66951	11
50	9.80374	0.63642	9.80942	0.64479	9.81500	0.65312	9.82047	0.66141	9.82584	0.66964	10
51	.80384	.63656	.80952	.64493	.81509	.65326	.82056	.66155	.82593	.66978	9
52	.80393	.63670	.80961	.64507	.81518	.65340	.82065	.66168	.82602	.66992	8
53	.80403	.63684	.80970	.64521	.81527	.65354	.82074	.66182	.82611	.67005	7
54	.80413	.63698	.80980	.64535	.81536	.65368	.82083	.66196	.82620	.67019	6
55	9.80422	0.63712	9.80989	0.64549	9.81546	0.65382	9.82092	0.66210	9.82629	0.67033	5
56	.80432	.63726	.80998	.64563	.81555	.65396	.82101	.66223	.82638	.67046	4
57	.80441	.63740	.81008	.64577	.81564	.65409	.82110	.66237	.82646	.67060	3
58	.80451	.63754	.81017	.64591	.81573	.65423	.82119	.66251	.82655	.67074	2
59	.80460	.63768	.81026	.64605	.81582	.65437	.82128	.66265	.82664	.67087	1
60	9.80470	0.63782	9.81036	0.64619	9.81592	0.65451	9.82137	0.66278	9.82673	0.67101	0
	254°		253°		252°		251°		250°		

Haversines

	110°		111°		112°		113°		114°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.82673	0.67101	9.83199	0.67918	9.83715	0.68730	9.84221	0.69537	9.84718	0.70337	60
1	82682	67115	83207	67932	83723	68744	84230	69550	84726	70350	59
2	82691	67128	83216	67946	83732	68757	84238	69563	84735	70363	58
3	82699	67142	83225	67959	83740	68771	84246	69577	84743	70377	57
4	82708	67156	83233	67973	83749	68784	84255	69590	84751	70390	56
5	9.82717	0.67169	9.83242	0.67986	9.83757	0.68798	9.84263	0.69603	9.84759	0.70403	55
6	82726	67183	83251	68000	83766	68811	84271	69617	84767	70417	54
7	82735	67197	83259	68013	83774	68825	84280	69630	84776	70430	53
8	82744	67210	83268	68027	83783	68838	84288	69644	84784	70443	52
9	82752	67224	83277	68041	83791	68852	84296	69657	84792	70456	51
10	9.82761	0.67238	9.83285	0.68054	9.83800	0.68865	9.84305	0.69670	9.84800	0.70470	50
11	82770	67251	83294	68068	83808	68879	84313	69684	84808	70483	49
12	82779	67265	83303	68081	83817	68892	84321	69697	84817	70496	48
13	82788	67279	83311	68095	83825	68906	84330	69710	84825	70509	47
14	82796	67292	83320	68108	83834	68919	84338	69724	84833	70523	46
15	9.82805	0.67306	9.83329	0.68122	9.83842	0.68932	9.84346	0.69737	9.84841	0.70536	45
16	82814	67319	83337	68135	83851	68946	84355	69751	84849	70549	44
17	82823	67333	83346	68149	83859	68959	84363	69764	84857	70562	43
18	82832	67347	83355	68163	83868	68973	84371	69777	84866	70576	42
19	82840	67360	83363	68176	83876	68986	84380	69791	84874	70589	41
20	9.82849	0.67374	9.83372	0.68190	9.83885	0.69000	9.84388	0.69804	9.84882	0.70602	40
21	82858	67388	83380	68203	83893	69013	84396	69817	84890	70615	39
22	82867	67401	83389	68217	83902	69027	84405	69831	84898	70629	38
23	82876	67415	83398	68230	83910	69040	84413	69844	84906	70642	37
24	82884	67429	83406	68244	83919	69054	84421	69857	84914	70655	36
25	9.82893	0.67442	9.83415	0.68257	9.83927	0.69067	9.84430	0.69871	9.84923	0.70668	35
26	82902	67456	83424	68271	83935	69080	84438	69884	84931	70682	34
27	82911	67469	83432	68284	83944	69094	84446	69897	84939	70695	33
28	82920	67483	83441	68298	83952	69107	84454	69911	84947	70708	32
29	82928	67497	83449	68312	83961	69121	84463	69924	84955	70721	31
30	9.82937	0.67510	9.83458	0.68325	9.83969	0.69134	9.84471	0.69937	9.84963	0.70735	30
31	82946	67524	83467	68339	83978	69148	84479	69951	84971	70748	29
32	82955	67538	83475	68352	83986	69161	84488	69964	84979	70761	28
33	82963	67551	83484	68366	83995	69174	84496	69977	84988	70774	27
34	82972	67565	83492	68379	84003	69188	84504	69991	84996	70788	26
35	9.82981	0.67578	9.83501	0.68393	9.84011	0.69201	9.84512	0.70004	9.85004	0.70801	25
36	82990	67592	83510	68406	84020	69215	84521	70017	85012	70814	24
37	82998	67606	83518	68420	84028	69228	84529	70031	85020	70827	23
38	83007	67619	83527	68433	84037	69242	84537	70044	85028	70840	22
39	83016	67633	83535	68447	84045	69255	84545	70057	85036	70854	21
40	9.83025	0.67647	9.83544	0.68460	9.84054	0.69268	9.84554	0.70071	9.85044	0.70867	20
41	83033	67660	83552	68474	84062	69282	84562	70084	85052	70880	19
42	83042	67674	83561	68487	84070	69295	84570	70097	85061	70893	18
43	83051	67687	83570	68501	84079	69309	84578	70111	85069	70907	17
44	83059	67701	83578	68514	84087	69322	84587	70124	85077	70920	16
45	9.83068	0.67715	9.83587	0.68528	9.84096	0.69336	9.84595	0.70137	9.85085	0.70933	15
46	83077	67728	83595	68541	84104	69349	84603	70151	85093	70946	14
47	83086	67742	83604	68555	84112	69362	84611	70164	85101	70959	13
48	83094	67755	83612	68568	84121	69376	84620	70177	85109	70973	12
49	83103	67769	83621	68582	84129	69389	84628	70191	85117	70986	11
50	9.83112	0.67783	9.83630	0.68595	9.84138	0.69403	9.84636	0.70204	9.85125	0.70999	10
51	83120	67796	83638	68609	84146	69416	84644	70217	85133	71012	9
52	83129	67810	83647	68622	84154	69429	84653	70230	85141	71025	8
53	83138	67823	83655	68636	84163	69443	84661	70244	85149	71039	7
54	83147	67837	83664	68649	84171	69456	84669	70257	85158	71052	6
55	9.83155	0.67850	9.83672	0.68663	9.84179	0.69470	9.84677	0.70270	9.85166	0.71065	5
56	83164	67864	83681	68676	84188	69483	84685	70284	85174	71078	4
57	83173	67878	83689	68690	84196	69496	84694	70297	85182	71091	3
58	83181	67891	83698	68703	84205	69510	84702	70310	85190	71105	2
59	83190	67905	83706	68717	84213	69523	84710	70324	85198	71118	1
60	9.83199	0.67918	9.83715	0.68730	9.84221	0.69537	9.84718	0.70337	9.85206	0.71131	0
	249°		248°		247°		246°		245°		

2

Haversines

	115°		116°		117°		118°		119°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.85206	0.71131	9.85684	0.71919	9.86153	0.72700	9.86613	0.73474	9.87064	0.74240	60
1	.85214	.71144	.85692	.71932	.86161	.72712	.86621	.73486	.87072	.74253	59
2	.85222	.71157	.85700	.71945	.86169	.72725	.86628	.73499	.87079	.74266	58
3	.85230	.71170	.85708	.71958	.86176	.72738	.86636	.73512	.87086	.74279	57
4	.85238	.71184	.85716	.71971	.86184	.72751	.86643	.73525	.87094	.74291	56
5	9.85246	0.71197	9.85724	0.71984	9.86192	0.72764	9.86651	0.73538	9.87101	0.74304	55
6	.85254	.71210	.85731	.71997	.86200	.72777	.86659	.73551	.87109	.74317	54
7	.85262	.71223	.85739	.72010	.86207	.72790	.86666	.73563	.87116	.74329	53
8	.85270	.71236	.85747	.72023	.86215	.72803	.86674	.73576	.87124	.74342	52
9	.85278	.71249	.85755	.72036	.86223	.72816	.86681	.73589	.87131	.74355	51
10	9.85286	0.71263	9.85763	0.72049	9.86230	0.72829	9.86689	0.73602	9.87138	0.74368	50
11	.85294	.71276	.85771	.72062	.86238	.72842	.86696	.73615	.87146	.74380	49
12	.85302	.71289	.85779	.72075	.86246	.72855	.86704	.73628	.87153	.74393	48
13	.85310	.71302	.85787	.72088	.86254	.72868	.86712	.73640	.87161	.74406	47
14	.85318	.71315	.85794	.72101	.86261	.72881	.86719	.73653	.87168	.74418	46
15	9.85326	0.71328	9.85802	0.72114	9.86269	0.72894	9.86727	0.73666	9.87175	0.74431	45
16	.85334	.71342	.85810	.72127	.86277	.72907	.86734	.73679	.87183	.74444	44
17	.85342	.71355	.85818	.72141	.86284	.72920	.86742	.73692	.87190	.74456	43
18	.85350	.71368	.85826	.72154	.86292	.72932	.86749	.73704	.87198	.74469	42
19	.85358	.71381	.85834	.72167	.86300	.72945	.86757	.73717	.87205	.74482	41
20	9.85366	0.71394	9.85841	0.72180	9.86307	0.72958	9.86764	0.73730	9.87212	0.74494	40
21	.85374	.71407	.85849	.72193	.86315	.72971	.86772	.73743	.87220	.74507	39
22	.85382	.71420	.85857	.72206	.86323	.72984	.86780	.73756	.87227	.74520	38
23	.85390	.71434	.85865	.72219	.86331	.72997	.86787	.73768	.87235	.74533	37
24	.85398	.71447	.85873	.72232	.86338	.73010	.86795	.73781	.87242	.74545	36
25	9.85406	0.71460	9.85881	0.72245	9.86346	0.73023	9.86802	0.73794	9.87249	0.74558	35
26	.85414	.71473	.85888	.72258	.86354	.73036	.86810	.73807	.87257	.74571	34
27	.85422	.71486	.85896	.72271	.86361	.73049	.86817	.73820	.87264	.74583	33
28	.85430	.71499	.85904	.72284	.86369	.73062	.86825	.73832	.87271	.74596	32
29	.85438	.71512	.85912	.72297	.86377	.73075	.86832	.73845	.87279	.74609	31
30	9.85446	0.71526	9.85920	0.72310	9.86384	0.73087	9.86840	0.73858	9.87286	0.74621	30
31	.85454	.71539	.85928	.72323	.86392	.73100	.86847	.73871	.87294	.74634	29
32	.85462	.71552	.85935	.72336	.86400	.73113	.86855	.73883	.87301	.74646	28
33	.85470	.71565	.85943	.72349	.86407	.73126	.86862	.73896	.87308	.74659	27
34	.85478	.71578	.85951	.72362	.86415	.73139	.86870	.73909	.87316	.74672	26
35	9.85486	0.71591	9.85959	0.72375	9.86423	0.73152	9.86877	0.73922	9.87323	0.74684	25
36	.85494	.71604	.85967	.72388	.86430	.73165	.86885	.73935	.87330	.74697	24
37	.85502	.71617	.85974	.72401	.86438	.73178	.86892	.73947	.87338	.74710	23
38	.85510	.71631	.85982	.72414	.86446	.73191	.86900	.73960	.87345	.74722	22
39	.85518	.71644	.85990	.72427	.86453	.73203	.86907	.73973	.87352	.74735	21
40	9.85526	0.71657	9.85998	0.72440	9.86461	0.73216	9.86915	0.73986	9.87360	0.74748	20
41	.85534	.71670	.86006	.72453	.86468	.73229	.86922	.73998	.87367	.74760	19
42	.85542	.71683	.86013	.72466	.86476	.73242	.86930	.74011	.87374	.74773	18
43	.85550	.71696	.86021	.72479	.86484	.73255	.86937	.74024	.87382	.74786	17
44	.85557	.71709	.86029	.72492	.86491	.73268	.86945	.74037	.87389	.74798	16
45	9.85565	0.71722	9.86037	0.72505	9.86499	0.73281	9.86952	0.74049	9.87396	0.74811	15
46	.85573	.71735	.86045	.72518	.86507	.73294	.86960	.74062	.87404	.74823	14
47	.85581	.71748	.86052	.72531	.86514	.73306	.86967	.74075	.87411	.74836	13
48	.85589	.71762	.86060	.72544	.86522	.73319	.86975	.74088	.87418	.74849	12
49	.85597	.71775	.86068	.72557	.86529	.73332	.86982	.74100	.87426	.74861	11
50	9.85605	0.71788	9.86076	0.72570	9.86537	0.73345	9.86990	0.74113	9.87433	0.74874	10
51	.85613	.71801	.86083	.72583	.86545	.73358	.86997	.74126	.87440	.74887	9
52	.85621	.71814	.86091	.72596	.86552	.73371	.87004	.74139	.87448	.74899	8
53	.85629	.71827	.86099	.72609	.86560	.73384	.87012	.74151	.87455	.74912	7
54	.85637	.71840	.86107	.72622	.86568	.73396	.87019	.74164	.87462	.74924	6
55	9.85645	0.71853	9.86114	0.72635	9.86575	0.73409	9.87027	0.74177	9.87470	0.74937	5
56	.85653	.71866	.86122	.72648	.86583	.73422	.87034	.74190	.87477	.74950	4
57	.85660	.71879	.86130	.72661	.86590	.73435	.87042	.74202	.87484	.74962	3
58	.85668	.71892	.86138	.72674	.86598	.73448	.87049	.74215	.87492	.74975	2
59	.85676	.71905	.86145	.72687	.86606	.73461	.87057	.74228	.87499	.74987	1
60	9.85684	0.71919	9.86153	0.72700	9.86613	0.73474	9.87064	0.74240	9.87506	0.75000	0
	244°		243°		242°		241°		240°		

Haversines

	120°		121°		122°		123°		124°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.87506	0.75000	9.87939	0.75752	9.88364	0.76496	9.88780	0.77232	9.89187	0.77960	60
1	.87513	.75013	.87947	.75764	.88371	.76508	.88787	.77244	.89194	.77972	59
2	.87521	.75025	.87954	.75777	.88378	.76521	.88793	.77256	.89200	.77984	58
3	.87528	.75038	.87961	.75789	.88385	.76533	.88800	.77269	.89207	.77996	57
4	.87535	.75050	.87968	.75802	.88392	.76545	.88807	.77281	.89214	.78008	56
5	9.87543	0.75063	9.87975	0.75814	9.88399	0.76558	9.88814	0.77293	9.89221	0.78020	55
6	.87550	.75076	.87982	.75827	.88406	.76570	.88821	.77305	.89227	.78032	54
7	.87557	.75088	.87989	.75839	.88413	.76582	.88828	.77317	.89234	.78044	53
8	.87564	.75101	.87996	.75852	.88420	.76595	.88835	.77329	.89241	.78056	52
9	.87572	.75113	.88004	.75864	.88427	.76607	.88841	.77342	.89247	.78068	51
10	9.87579	0.75126	9.88011	0.75876	9.88434	0.76619	9.88848	0.77354	9.89254	0.78080	50
11	.87586	.75138	.88018	.75889	.88441	.76632	.88855	.77366	.89261	.78092	49
12	.87593	.75151	.88025	.75901	.88448	.76644	.88862	.77378	.89267	.78104	48
13	.87601	.75164	.88032	.75914	.88455	.76656	.88869	.77390	.89274	.78116	47
14	.87608	.75176	.88039	.75926	.88462	.76668	.88876	.77402	.89281	.78128	46
15	9.87615	0.75189	9.88046	0.75939	9.88469	0.76681	9.88882	0.77415	9.89287	0.78140	45
16	.87623	.75201	.88053	.75951	.88476	.76693	.88889	.77427	.89294	.78152	44
17	.87630	.75214	.88061	.75964	.88483	.76705	.88896	.77439	.89301	.78164	43
18	.87637	.75226	.88068	.75976	.88490	.76718	.88903	.77451	.89308	.78176	42
19	.87644	.75239	.88075	.75988	.88496	.76730	.88910	.77463	.89314	.78188	41
20	9.87652	0.75251	9.88082	0.76001	9.88503	0.76742	9.88916	0.77475	9.89321	0.78200	40
21	.87659	.75264	.88089	.76013	.88510	.76754	.88923	.77488	.89328	.78212	39
22	.87666	.75277	.88096	.76026	.88517	.76767	.88930	.77500	.89334	.78224	38
23	.87673	.75289	.88103	.76038	.88524	.76779	.88937	.77512	.89341	.78236	37
24	.87680	.75302	.88110	.76050	.88531	.76791	.88944	.77524	.89348	.78248	36
25	9.87688	0.75314	9.88117	0.76063	9.88538	0.76804	9.88950	0.77536	9.89354	0.78260	35
26	.87695	.75327	.88124	.76075	.88545	.76816	.88957	.77548	.89361	.78272	34
27	.87702	.75339	.88131	.76088	.88552	.76828	.88964	.77560	.89368	.78284	33
28	.87709	.75352	.88139	.76100	.88559	.76840	.88971	.77573	.89374	.78296	32
29	.87717	.75364	.88146	.76113	.88566	.76853	.88978	.77585	.89381	.78308	31
30	9.87724	0.75377	9.88153	0.76125	9.88573	0.76865	9.88984	0.77597	9.89387	0.78320	30
31	.87731	.75389	.88160	.76137	.88580	.76877	.88991	.77609	.89394	.78332	29
32	.87738	.75402	.88167	.76150	.88587	.76890	.88998	.77621	.89400	.78344	28
33	.87745	.75415	.88174	.76162	.88594	.76902	.89005	.77633	.89407	.78356	27
34	.87753	.75427	.88181	.76175	.88600	.76914	.89012	.77645	.89414	.78368	26
35	9.87760	0.75440	9.88188	0.76187	9.88607	0.76926	9.89018	0.77657	9.89421	0.78380	25
36	.87767	.75452	.88195	.76199	.88614	.76939	.89025	.77670	.89427	.78392	24
37	.87774	.75465	.88202	.76212	.88621	.76951	.89032	.77682	.89434	.78404	23
38	.87782	.75477	.88209	.76224	.88628	.76963	.89039	.77694	.89441	.78416	22
39	.87789	.75490	.88216	.76236	.88635	.76975	.89045	.77706	.89447	.78428	21
40	9.87796	0.75502	9.88223	0.76249	9.88642	0.76988	9.89052	0.77718	9.89454	0.78440	20
41	.87803	.75515	.88230	.76261	.88649	.77000	.89059	.77730	.89460	.78452	19
42	.87810	.75527	.88237	.76274	.88656	.77012	.89066	.77742	.89467	.78464	18
43	.87818	.75540	.88244	.76286	.88663	.77024	.89072	.77754	.89474	.78476	17
44	.87825	.75552	.88252	.76298	.88670	.77036	.89079	.77766	.89480	.78488	16
45	9.87832	0.75565	9.88259	0.76311	9.88677	0.77049	9.89086	0.77779	9.89487	0.78500	15
46	.87839	.75577	.88266	.76323	.88683	.77061	.89093	.77791	.89493	.78512	14
47	.87846	.75590	.88273	.76335	.88690	.77073	.89099	.77803	.89500	.78524	13
48	.87853	.75602	.88280	.76348	.88697	.77085	.89106	.77815	.89507	.78536	12
49	.87861	.75615	.88287	.76360	.88704	.77098	.89113	.77827	.89513	.78548	11
50	9.87868	0.75627	9.88294	0.76373	9.88711	0.77110	9.89120	0.77839	9.89520	0.78560	10
51	.87875	.75640	.88301	.76385	.88718	.77122	.89126	.77851	.89527	.78571	9
52	.87882	.75652	.88308	.76397	.88725	.77134	.89133	.77863	.89533	.78583	8
53	.87889	.75665	.88315	.76410	.88732	.77147	.89140	.77875	.89540	.78595	7
54	.87896	.75677	.88322	.76422	.88739	.77159	.89147	.77887	.89546	.78607	6
55	9.87904	0.75690	9.88329	0.76434	9.88745	0.77171	9.89153	0.77899	9.89553	0.78619	5
56	.87911	.75702	.88336	.76447	.88752	.77183	.89160	.77911	.89559	.78631	4
57	.87918	.75714	.88343	.76459	.88759	.77195	.89167	.77923	.89566	.78643	3
58	.87925	.75727	.88350	.76471	.88766	.77208	.89174	.77936	.89573	.78655	2
59	.87932	.75739	.88357	.76484	.88773	.77220	.89180	.77948	.89579	.78667	1
60	9.87939	0.75752	9.88364	0.76496	9.88780	0.77232	9.89187	0.77960	9.89586	0.78679	0
	239°		238°		237°		236°		235°		

2

Haversines

	125°		126°		127°		128°		129°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.89586	0.78679	9.89976	0.79389	9.90358	0.80091	9.90732	0.80783	9.91098	0.81466	60
1	.89592	.78691	.89983	.79401	.90365	.80102	.90738	.80795	.91104	.81477	59
2	.89599	.78703	.89989	.79413	.90371	.80114	.90744	.80806	.91110	.81489	58
3	.89606	.78715	.89995	.79425	.90377	.80126	.90751	.80817	.91116	.81500	57
4	.89612	.78726	.90002	.79436	.90383	.80137	.90757	.80829	.91122	.81511	56
5	9.89619	0.78738	9.90008	0.79448	9.90390	0.80149	9.90763	0.80840	9.91128	0.81523	55
6	.89625	.78750	.90015	.79460	.90396	.80160	.90769	.80852	.91134	.81534	54
7	.89632	.78762	.90021	.79472	.90402	.80172	.90775	.80863	.91140	.81545	53
8	.89638	.78774	.90028	.79483	.90409	.80184	.90781	.80875	.91146	.81556	52
9	.89645	.78786	.90034	.79495	.90415	.80195	.90787	.80886	.91152	.81568	51
10	9.89651	0.78798	9.90040	0.79507	9.90421	0.80207	9.90794	0.80898	9.91158	0.81579	50
11	.89658	.78810	.90047	.79519	.90428	.80218	.90800	.80909	.91164	.81590	49
12	.89665	.78822	.90053	.79530	.90434	.80230	.90806	.80920	.91170	.81601	48
13	.89671	.78833	.90060	.79542	.90440	.80242	.90812	.80932	.91176	.81613	47
14	.89678	.78845	.90066	.79554	.90446	.80253	.90818	.80943	.91182	.81624	46
15	9.89684	0.78857	9.90072	0.79565	9.90452	0.80265	9.90824	0.80955	9.91188	0.81635	45
16	.89691	.78869	.90079	.79577	.90459	.80276	.90830	.80966	.91194	.81647	44
17	.89697	.78881	.90085	.79589	.90465	.80288	.90836	.80978	.91200	.81658	43
18	.89704	.78893	.90092	.79601	.90471	.80299	.90843	.80989	.91206	.81669	42
19	.89710	.78905	.90098	.79612	.90478	.80311	.90849	.81000	.91212	.81680	41
20	9.89717	0.78917	9.90104	0.79624	9.90484	0.80323	9.90855	0.81012	9.91218	0.81692	40
21	.89723	.78928	.90111	.79636	.90490	.80334	.90861	.81023	.91224	.81703	39
22	.89730	.78940	.90117	.79648	.90496	.80346	.90867	.81035	.91230	.81714	38
23	.89736	.78952	.90124	.79659	.90503	.80357	.90873	.81046	.91236	.81725	37
24	.89743	.78964	.90130	.79671	.90509	.80369	.90879	.81057	.91242	.81737	36
25	9.89749	0.78976	9.90136	0.79683	9.90515	0.80380	9.90885	0.81069	9.91248	0.81748	35
26	.89756	.78988	.90143	.79694	.90521	.80392	.90892	.81080	.91254	.81759	34
27	.89763	.79000	.90149	.79706	.90527	.80403	.90898	.81092	.91260	.81770	33
28	.89769	.79011	.90156	.79718	.90534	.80415	.90904	.81103	.91265	.81781	32
29	.89776	.79023	.90162	.79729	.90540	.80427	.90910	.81114	.91271	.81793	31
30	9.89782	0.79035	9.90168	0.79741	9.90546	0.80438	9.90916	0.81126	9.91277	0.81804	30
31	.89789	.79047	.90175	.79753	.90552	.80450	.90922	.81137	.91283	.81815	29
32	.89795	.79059	.90181	.79765	.90559	.80461	.90928	.81148	.91289	.81826	28
33	.89802	.79071	.90187	.79776	.90565	.80473	.90934	.81160	.91295	.81838	27
34	.89808	.79082	.90194	.79788	.90571	.80484	.90940	.81171	.91301	.81849	26
35	9.89815	0.79094	9.90200	0.79800	9.90577	0.80496	9.90946	0.81183	9.91307	0.81860	25
36	.89821	.79106	.90206	.79811	.90584	.80507	.90952	.81194	.91313	.81871	24
37	.89828	.79118	.90213	.79823	.90590	.80519	.90958	.81205	.91319	.81882	23
38	.89834	.79130	.90219	.79835	.90596	.80530	.90965	.81217	.91325	.81894	22
39	.89840	.79142	.90225	.79846	.90602	.80542	.90971	.81228	.91331	.81905	21
40	9.89847	0.79153	9.90232	0.79858	9.90608	0.80553	9.90977	0.81239	9.91337	0.81916	20
41	.89853	.79165	.90238	.79870	.90615	.80565	.90983	.81251	.91343	.81927	19
42	.89860	.79177	.90244	.79881	.90621	.80576	.90989	.81262	.91349	.81938	18
43	.89866	.79189	.90251	.79893	.90627	.80588	.90995	.81273	.91355	.81950	17
44	.89873	.79201	.90257	.79905	.90633	.80599	.91001	.81285	.91361	.81961	16
45	9.89879	0.79212	9.90264	0.79916	9.90639	0.80611	9.91007	0.81296	9.91367	0.81972	15
46	.89886	.79224	.90270	.79928	.90646	.80622	.91013	.81308	.91372	.81983	14
47	.89892	.79236	.90276	.79940	.90652	.80634	.91019	.81319	.91378	.81994	13
48	.89899	.79248	.90282	.79951	.90658	.80645	.91025	.81330	.91384	.82005	12
49	.89905	.79260	.90289	.79963	.90664	.80657	.91031	.81342	.91390	.82017	11
50	9.89912	0.79271	9.90295	0.79974	9.90670	0.80668	9.91037	0.81353	9.91396	0.82028	10
51	.89918	.79283	.90301	.79986	.90676	.80680	.91043	.81364	.91402	.82039	9
52	.89925	.79295	.90308	.79998	.90683	.80691	.91049	.81376	.91408	.82050	8
53	.89931	.79307	.90314	.80009	.90689	.80703	.91055	.81387	.91414	.82061	7
54	.89938	.79319	.90320	.80021	.90695	.80714	.91061	.81398	.91420	.82072	6
55	9.89944	0.79330	9.90327	0.80033	9.90701	0.80726	9.91067	0.81409	9.91426	0.82084	5
56	.89950	.79342	.90333	.80044	.90707	.80737	.91074	.81421	.91432	.82095	4
57	.89957	.79354	.90339	.80056	.90714	.80749	.91080	.81432	.91437	.82106	3
58	.89963	.79366	.90346	.80068	.90720	.80760	.91086	.81443	.91443	.82117	2
59	.89970	.79377	.90352	.80079	.90726	.80772	.91092	.81455	.91449	.82128	1
60	9.89976	0.79389	9.90358	0.80091	9.90732	0.80783	9.91098	0.81466	9.91455	0.82139	0
	234°		233°		232°		231°		230°		

Haversines

	130°		131°		132°		133°		134°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.91455	0.82139	9.91805	0.82803	9.92146	0.83457	9.92480	0.84100	9.92805	0.84733	60
1	9.91461	82151	9.91810	82814	9.92152	83467	9.92485	84111	9.92811	84743	59
2	9.91467	82162	9.91816	82825	9.92157	83478	9.92491	84121	9.92816	84754	58
3	9.91473	82173	9.91822	82836	9.92163	83489	9.92496	84132	9.92821	84764	57
4	9.91479	82184	9.91828	82847	9.92169	83500	9.92502	84142	9.92827	84775	56
5	9.91485	0.82195	9.91833	0.82858	9.92174	0.83511	9.92507	0.84153	9.92832	0.84785	55
6	9.91490	82206	9.91839	82869	9.92180	83521	9.92512	84164	9.92837	84796	54
7	9.91496	82217	9.91845	82880	9.92185	83532	9.92518	84174	9.92843	84806	53
8	9.91502	82228	9.91851	82891	9.92191	83543	9.92523	84185	9.92848	84817	52
9	9.91508	82240	9.91856	82902	9.92197	83554	9.92529	84196	9.92853	84827	51
10	9.91514	0.82251	9.91862	0.82913	9.92202	0.83564	9.92534	0.84206	9.92859	0.84837	50
11	9.91520	82262	9.91868	82924	9.92208	83575	9.92540	84217	9.92864	84848	49
12	9.91526	82273	9.91874	82934	9.92213	83586	9.92545	84227	9.92869	84858	48
13	9.91532	82284	9.91879	82945	9.92219	83597	9.92551	84238	9.92875	84869	47
14	9.91537	82295	9.91885	82956	9.92225	83608	9.92556	84249	9.92880	84879	46
15	9.91543	0.82306	9.91891	0.82967	9.92230	0.83618	9.92562	0.84259	9.92885	0.84890	45
16	9.91549	82317	9.91896	82978	9.92236	83629	9.92567	84270	9.92891	84900	44
17	9.91555	82328	9.91902	82989	9.92241	83640	9.92573	84280	9.92896	84910	43
18	9.91561	82339	9.91908	83000	9.92247	83651	9.92578	84291	9.92901	84921	42
19	9.91567	82351	9.91914	83011	9.92253	83661	9.92584	84302	9.92907	84931	41
20	9.91573	0.82362	9.91919	0.83022	9.92258	0.83672	9.92589	0.84312	9.92912	0.84942	40
21	9.91578	82373	9.91925	83033	9.92264	83683	9.92594	84323	9.92917	84952	39
22	9.91584	82384	9.91931	83044	9.92269	83694	9.92600	84333	9.92923	84962	38
23	9.91590	82395	9.91936	83055	9.92275	83704	9.92605	84344	9.92928	84973	37
24	9.91596	82406	9.91942	83066	9.92280	83715	9.92611	84354	9.92933	84983	36
25	9.91602	0.82417	9.91948	0.83077	9.92286	0.83726	9.92616	0.84365	9.92939	0.84994	35
26	9.91608	82428	9.91954	83087	9.92292	83737	9.92622	84376	9.92944	85004	34
27	9.91613	82439	9.91959	83098	9.92297	83747	9.92627	84386	9.92949	85014	33
28	9.91619	82450	9.91965	83109	9.92303	83758	9.92633	84397	9.92955	85025	32
29	9.91625	82461	9.91971	83120	9.92308	83769	9.92638	84407	9.92960	85035	31
30	9.91631	0.82472	9.91976	0.83131	9.92314	0.83780	9.92643	0.84418	9.92965	0.85045	30
31	9.91637	82483	9.91982	83142	9.92319	83790	9.92649	84428	9.92970	85056	29
32	9.91643	82495	9.91988	83153	9.92325	83801	9.92654	84439	9.92975	85066	28
33	9.91648	82506	9.91993	83164	9.92330	83812	9.92660	84449	9.92981	85077	27
34	9.91654	82517	9.91999	83175	9.92336	83822	9.92665	84460	9.92986	85087	26
35	9.91660	0.82528	9.92005	0.83185	9.92342	0.83833	9.92670	0.84470	9.92992	0.85097	25
36	9.91666	82539	9.92010	83196	9.92347	83844	9.92676	84481	9.92997	85108	24
37	9.91672	82550	9.92016	83207	9.92353	83855	9.92681	84492	9.93002	85118	23
38	9.91677	82561	9.92022	83218	9.92358	83865	9.92687	84502	9.93007	85128	22
39	9.91683	82572	9.92027	83229	9.92364	83876	9.92692	84513	9.93013	85139	21
40	9.91689	0.82583	9.92033	0.83240	9.92369	0.83887	9.92698	0.84523	9.93018	0.85149	20
41	9.91695	82594	9.92039	83251	9.92375	83897	9.92703	84534	9.93023	85159	19
42	9.91701	82605	9.92044	83262	9.92380	83908	9.92708	84544	9.93029	85170	18
43	9.91706	82616	9.92050	83272	9.92386	83919	9.92714	84555	9.93034	85180	17
44	9.91712	82627	9.92056	83283	9.92391	83929	9.92719	84565	9.93039	85190	16
45	9.91718	0.82638	9.92061	0.83294	9.92397	0.83940	9.92725	0.84576	9.93044	0.85201	15
46	9.91724	82649	9.92067	83305	9.92402	83951	9.92730	84586	9.93050	85211	14
47	9.91730	82660	9.92073	83316	9.92408	83961	9.92735	84597	9.93055	85221	13
48	9.91735	82671	9.92078	83327	9.92413	83972	9.92741	84607	9.93060	85232	12
49	9.91741	82682	9.92084	83337	9.92419	83983	9.92746	84618	9.93066	85242	11
50	9.91747	0.82693	9.92090	0.83348	9.92425	0.83993	9.92751	0.84628	9.93071	0.85252	10
51	9.91753	82704	9.92095	83359	9.92430	84004	9.92757	84639	9.93076	85263	9
52	9.91758	82715	9.92101	83370	9.92436	84015	9.92762	84649	9.93081	85273	8
53	9.91764	82726	9.92107	83381	9.92441	84025	9.92768	84660	9.93086	85283	7
54	9.91770	82737	9.92112	83392	9.92447	84036	9.92773	84670	9.93092	85294	6
55	9.91776	0.82748	9.92118	0.83402	9.92452	0.84047	9.92778	0.84681	9.93097	0.85304	5
56	9.91782	82759	9.92124	83413	9.92458	84057	9.92784	84691	9.93102	85314	4
57	9.91787	82770	9.92129	83424	9.92463	84068	9.92789	84702	9.93107	85324	3
58	9.91793	82781	9.92135	83435	9.92469	84079	9.92794	84712	9.93113	85335	2
59	9.91799	82792	9.92140	83446	9.92474	84089	9.92800	84722	9.93118	85345	1
60	9.91805	0.82803	9.92146	0.83457	9.92480	0.84100	9.92805	0.84733	9.93123	0.85355	0
	229°		228°		227°		226°		225°		

2

Haversines

	135°		136°		137°		138°		139°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9. 93123	0. 85355	9. 93433	0. 85967	9. 93736	0. 86568	9. 94030	0. 87157	9. 94318	0. 87735	60
1	. 93128	. 85366	. 93438	. 85977	. 93741	. 86578	. 94035	. 87167	. 94322	. 87745	59
2	. 93134	. 85376	. 93443	. 85987	. 93746	. 86588	. 94040	. 87177	. 94327	. 87755	58
3	. 93139	. 85386	. 93448	. 85997	. 93751	. 86597	. 94045	. 87186	. 94332	. 87764	57
4	. 93144	. 85396	. 93454	. 86007	. 93755	. 86607	. 94050	. 87196	. 94336	. 87774	56
5	9. 93149	0. 85407	9. 93459	0. 86017	9. 93760	0. 86617	9. 94055	0. 87206	9. 94341	0. 87783	55
6	. 93154	. 85417	. 93464	. 86028	. 93765	. 86627	. 94059	. 87216	. 94346	. 87793	54
7	. 93160	. 85427	. 93469	. 86038	. 93770	. 86637	. 94064	. 87225	. 94351	. 87802	53
8	. 93165	. 85438	. 93474	. 86048	. 93775	. 86647	. 94069	. 87235	. 94355	. 87812	52
9	. 93170	. 85448	. 93479	. 86058	. 93780	. 86657	. 94074	. 87245	. 94360	. 87821	51
10	9. 93175	0. 85458	9. 93484	0. 86068	9. 93785	0. 86667	9. 94079	0. 87254	9. 94365	0. 87831	50
11	. 93181	. 85468	. 93489	. 86078	. 93790	. 86677	. 94084	. 87264	. 94369	. 87840	49
12	. 93186	. 85479	. 93494	. 86088	. 93795	. 86686	. 94088	. 87274	. 94374	. 87850	48
13	. 93191	. 85489	. 93499	. 86098	. 93800	. 86696	. 94093	. 87283	. 94379	. 87859	47
14	. 93196	. 85499	. 93504	. 86108	. 93805	. 86706	. 94098	. 87293	. 94383	. 87869	46
15	9. 93201	0. 85509	9. 93509	0. 86118	9. 93810	0. 86716	9. 94103	0. 87303	9. 94388	0. 87878	45
16	. 93207	. 85520	. 93515	. 86128	. 93815	. 86726	. 94108	. 87313	. 94393	. 87888	44
17	. 93212	. 85530	. 93520	. 86138	. 93820	. 86736	. 94112	. 87322	. 94398	. 87897	43
18	. 93217	. 85540	. 93525	. 86148	. 93825	. 86746	. 94117	. 87332	. 94402	. 87907	42
19	. 93222	. 85550	. 93530	. 86158	. 93830	. 86756	. 94122	. 87342	. 94407	. 87916	41
20	9. 93227	0. 85560	9. 93535	0. 86168	9. 93835	0. 86765	9. 94127	0. 87351	9. 94412	0. 87926	40
21	. 93232	. 85571	. 93540	. 86178	. 93840	. 86775	. 94132	. 87361	. 94416	. 87935	39
22	. 93238	. 85581	. 93545	. 86189	. 93845	. 86785	. 94137	. 87371	. 94421	. 87945	38
23	. 93243	. 85591	. 93550	. 86199	. 93849	. 86795	. 94141	. 87380	. 94426	. 87954	37
24	. 93248	. 85601	. 93555	. 86209	. 93854	. 86805	. 94146	. 87390	. 94430	. 87964	36
25	9. 93253	0. 85612	9. 93560	0. 86219	9. 93859	0. 86815	9. 94151	0. 87400	9. 94435	0. 87973	35
26	. 93258	. 85622	. 93565	. 86229	. 93864	. 86825	. 94156	. 87409	. 94440	. 87982	34
27	. 93264	. 85632	. 93570	. 86239	. 93869	. 86834	. 94161	. 87419	. 94444	. 87992	33
28	. 93269	. 85642	. 93575	. 86249	. 93874	. 86844	. 94165	. 87429	. 94449	. 88001	32
29	. 93274	. 85652	. 93580	. 86259	. 93879	. 86854	. 94170	. 87438	. 94454	. 88011	31
30	9. 93279	0. 85663	9. 93585	0. 86269	9. 93884	0. 86864	9. 94175	0. 87448	9. 94458	0. 88020	30
31	. 93284	. 85673	. 93590	. 86279	. 93889	. 86874	. 94180	. 87457	. 94463	. 88030	29
32	. 93289	. 85683	. 93595	. 86289	. 93894	. 86884	. 94184	. 87467	. 94468	. 88039	28
33	. 93295	. 85693	. 93600	. 86299	. 93899	. 86893	. 94189	. 87477	. 94472	. 88049	27
34	. 93300	. 85703	. 93605	. 86309	. 93904	. 86903	. 94194	. 87486	. 94477	. 88058	26
35	9. 93305	0. 85713	9. 93611	0. 86319	9. 93908	0. 86913	9. 94199	0. 87496	9. 94482	0. 88067	25
36	. 93310	. 85724	. 93616	. 86329	. 93913	. 86923	. 94204	. 87506	. 94486	. 88077	24
37	. 93315	. 85734	. 93621	. 86339	. 93918	. 86933	. 94208	. 87515	. 94491	. 88086	23
38	. 93320	. 85744	. 93626	. 86349	. 93923	. 86942	. 94213	. 87525	. 94496	. 88096	22
39	. 93326	. 85754	. 93631	. 86359	. 93928	. 86952	. 94218	. 87534	. 94500	. 88105	21
40	9. 93331	0. 85764	9. 93636	0. 86369	9. 93933	0. 86962	9. 94223	0. 87544	9. 94505	0. 88115	20
41	. 93336	. 85774	. 93641	. 86379	. 93938	. 86972	. 94227	. 87554	. 94509	. 88124	19
42	. 93341	. 85785	. 93646	. 86389	. 93943	. 86982	. 94232	. 87563	. 94514	. 88133	18
43	. 93346	. 85795	. 93651	. 86399	. 93948	. 86991	. 94237	. 87573	. 94519	. 88143	17
44	. 93351	. 85805	. 93656	. 86409	. 93952	. 87001	. 94242	. 87582	. 94523	. 88152	16
45	9. 93356	0. 85815	9. 93661	0. 86419	9. 93957	0. 87011	9. 94246	0. 87592	9. 94528	0. 88162	15
46	. 93362	. 85825	. 93666	. 86429	. 93962	. 87021	. 94251	. 87602	. 94533	. 88171	14
47	. 93367	. 85835	. 93671	. 86438	. 93967	. 87030	. 94256	. 87611	. 94537	. 88180	13
48	. 93372	. 85846	. 93676	. 86448	. 93972	. 87040	. 94261	. 87621	. 94542	. 88190	12
49	. 93377	. 85856	. 93681	. 86458	. 93977	. 87050	. 94265	. 87630	. 94546	. 88199	11
50	9. 93382	0. 85866	9. 93686	0. 86468	9. 93982	0. 87060	9. 94270	0. 87640	9. 94551	0. 88209	10
51	. 93387	. 85876	. 93691	. 86478	. 93987	. 87070	. 94275	. 87649	. 94556	. 88218	9
52	. 93392	. 85886	. 93696	. 86488	. 93991	. 87079	. 94280	. 87659	. 94560	. 88227	8
53	. 93397	. 85896	. 93701	. 86498	. 93996	. 87089	. 94284	. 87669	. 94565	. 88237	7
54	. 93403	. 85906	. 93706	. 86508	. 94001	. 87099	. 94289	. 87678	. 94570	. 88246	6
55	9. 93408	0. 85916	9. 93711	0. 86518	9. 94006	0. 87109	9. 94294	0. 87688	9. 94574	0. 88255	5
56	. 93413	. 85927	. 93716	. 86528	. 94011	. 87118	. 94299	. 87697	. 94579	. 88265	4
57	. 93418	. 85937	. 93721	. 86538	. 94016	. 87128	. 94303	. 87707	. 94583	. 88274	3
58	. 93423	. 85947	. 93726	. 86548	. 94021	. 87138	. 94308	. 87716	. 94588	. 88284	2
59	. 93428	. 85957	. 93731	. 86558	. 94026	. 87148	. 94313	. 87726	. 94593	. 88293	1
60	9. 93433	0. 85967	9. 93736	0. 86568	9. 94030	0. 87157	9. 94318	0. 87735	9. 94597	0. 88302	0
224°		223°		222°		221°		220°			

Haversines

	140°		141°		142°		143°		144°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.94597	0.88302	9.94869	0.88857	9.95134	0.89401	9.95391	0.89932	9.95641	0.90451	60
1	.94602	.88312	.94874	.88866	.95138	.89409	.95396	.89941	.95645	.90459	59
2	.94606	.88321	.94878	.88876	.95143	.89418	.95400	.89949	.95649	.90468	58
3	.94611	.88330	.94883	.88885	.95147	.89427	.95404	.89958	.95654	.90476	57
4	.94616	.88340	.94887	.88894	.95151	.89436	.95408	.89967	.95658	.90485	56
5	9.94620	0.88349	9.94892	0.88903	9.95156	0.89445	9.95412	0.89975	9.95662	0.90494	55
6	.94625	.88358	.94896	.88912	.95160	.89454	.95417	.89984	.95666	.90502	54
7	.94629	.88368	.94901	.88921	.95164	.89463	.95421	.89993	.95670	.90511	53
8	.94634	.88377	.94905	.88930	.95169	.89472	.95425	.90002	.95674	.90519	52
9	.94638	.88386	.94909	.88940	.95173	.89481	.95429	.90010	.95678	.90528	51
10	9.94643	0.88396	9.94914	0.88949	9.95177	0.89490	9.95433	0.90019	9.95682	0.90536	50
11	.94648	.88405	.94918	.88958	.95182	.89499	.95438	.90028	.95686	.90545	49
12	.94652	.88414	.94923	.88967	.95186	.89508	.95442	.90037	.95690	.90553	48
13	.94657	.88423	.94927	.88976	.95190	.89517	.95446	.90045	.95694	.90562	47
14	.94661	.88433	.94932	.88985	.95195	.89526	.95450	.90054	.95699	.90570	46
15	9.94666	0.88442	9.94936	0.88994	9.95199	0.89534	9.95454	0.90063	9.95703	0.90579	45
16	.94670	.88451	.94941	.89003	.95203	.89543	.95459	.90071	.95707	.90587	44
17	.94675	.88461	.94945	.89012	.95208	.89552	.95463	.90080	.95711	.90596	43
18	.94680	.88470	.94950	.89022	.95212	.89561	.95467	.90089	.95715	.90604	42
19	.94684	.88479	.94954	.89031	.95216	.89570	.95471	.90097	.95719	.90613	41
20	9.94689	0.88489	9.94958	0.89040	9.95221	0.89579	9.95475	0.90106	9.95723	0.90621	40
21	.94693	.88498	.94963	.89049	.95225	.89588	.95480	.90115	.95727	.90630	39
22	.94698	.88507	.94967	.89058	.95229	.89597	.95484	.90124	.95731	.90638	38
23	.94702	.88516	.94972	.89067	.95234	.89606	.95488	.90132	.95735	.90647	37
24	.94707	.88526	.94976	.89076	.95238	.89614	.95492	.90141	.95739	.90655	36
25	9.94711	0.88535	9.94981	0.89085	9.95242	0.89623	9.95496	0.90150	9.95743	0.90664	35
26	.94716	.88544	.94985	.89094	.95246	.89632	.95501	.90158	.95747	.90672	34
27	.94721	.88553	.94989	.89103	.95251	.89641	.95505	.90167	.95751	.90680	33
28	.94725	.88563	.94994	.89112	.95255	.89650	.95509	.90176	.95755	.90689	32
29	.94730	.88572	.94998	.89121	.95259	.89659	.95513	.90184	.95759	.90697	31
30	9.94734	0.88581	9.95003	0.89130	9.95264	0.89668	9.95517	0.90193	9.95763	0.90706	30
31	.94739	.88590	.95007	.89139	.95268	.89677	.95521	.90201	.95768	.90714	29
32	.94743	.88600	.95011	.89149	.95272	.89685	.95526	.90210	.95772	.90723	28
33	.94748	.88609	.95016	.89158	.95276	.89694	.95530	.90219	.95776	.90731	27
34	.94752	.88618	.95020	.89167	.95281	.89703	.95534	.90227	.95780	.90740	26
35	9.94757	0.88627	9.95025	0.89176	9.95285	0.89712	9.95538	0.90236	9.95784	0.90748	25
36	.94761	.88637	.95029	.89185	.95289	.89721	.95542	.90245	.95788	.90756	24
37	.94766	.88646	.95033	.89194	.95294	.89730	.95546	.90253	.95792	.90765	23
38	.94770	.88655	.95038	.89203	.95298	.89738	.95550	.90262	.95796	.90773	22
39	.94774	.88664	.95042	.89212	.95302	.89747	.95555	.90271	.95800	.90782	21
40	9.94779	0.88674	9.95047	0.89221	9.95306	0.89756	9.95559	0.90279	9.95804	0.90790	20
41	.94784	.88683	.95051	.89230	.95311	.89765	.95563	.90288	.95808	.90798	19
42	.94788	.88692	.95055	.89239	.95315	.89774	.95567	.90296	.95812	.90807	18
43	.94793	.88701	.95060	.89248	.95319	.89782	.95571	.90305	.95816	.90815	17
44	.94797	.88710	.95064	.89257	.95323	.89791	.95575	.90314	.95820	.90824	16
45	9.94802	0.88720	9.95069	0.89266	9.95328	0.89800	9.95579	0.90322	9.95824	0.90832	15
46	.94806	.88729	.95073	.89275	.95332	.89809	.95584	.90331	.95828	.90840	14
47	.94811	.88738	.95077	.89284	.95336	.89818	.95588	.90339	.95832	.90849	13
48	.94815	.88747	.95082	.89293	.95340	.89826	.95592	.90348	.95836	.90857	12
49	.94820	.88756	.95086	.89302	.95345	.89835	.95596	.90357	.95840	.90866	11
50	9.94824	0.88766	9.95090	0.89311	9.95349	0.89844	9.95600	0.90365	9.95844	0.90874	10
51	.94829	.88775	.95095	.89320	.95353	.89853	.95604	.90374	.95848	.90882	9
52	.94833	.88784	.95099	.89329	.95357	.89862	.95608	.90382	.95852	.90891	8
53	.94838	.88793	.95104	.89338	.95362	.89870	.95613	.90391	.95856	.90899	7
54	.94842	.88802	.95108	.89347	.95366	.89879	.95617	.90399	.95860	.90907	6
55	9.94847	0.88811	9.95112	0.89356	9.95370	0.89888	9.95621	0.90408	9.95864	0.90916	5
56	.94851	.88821	.95117	.89365	.95374	.89897	.95625	.90417	.95868	.90924	4
57	.94856	.88830	.95121	.89374	.95379	.89906	.95629	.90425	.95872	.90933	3
58	.94860	.88839	.95125	.89383	.95383	.89914	.95633	.90434	.95876	.90941	2
59	.94865	.88848	.95130	.89392	.95387	.89923	.95637	.90442	.95880	.90949	1
60	9.94869	0.88857	9.95134	0.89401	9.95391	0.89932	9.95641	0.90451	9.95884	0.90958	0
	219°		218°		217°		216°		215°		

2

Haversines

	145°		146°		147°		148°		149°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.95884	0.90958	9.96119	0.91452	9.96347	0.91934	9.96568	0.92402	9.96782	0.92858	60
1	95888	90966	96123	91460	96351	91941	96572	92410	96786	92866	59
2	95892	90974	96127	91468	96355	91949	96576	92418	96789	92873	58
3	95896	90983	96131	91476	96359	91957	96579	92426	96793	92881	57
4	95900	90991	96135	91484	96362	91965	96583	92433	96796	92888	56
5	9.95904	0.90999	9.96139	0.91493	9.96366	0.91973	9.96586	0.92441	9.96800	0.92896	55
6	95908	91008	96142	91501	96370	91981	96590	92449	96803	92903	54
7	95912	91016	96146	91509	96374	91989	96594	92456	96807	92911	53
8	95916	91024	96150	91517	96377	91997	96597	92464	96810	92918	52
9	95920	91033	96154	91525	96381	92005	96601	92472	96814	92926	51
10	9.95924	0.91041	9.96158	0.91533	9.96385	0.92013	9.96604	0.92479	9.96817	0.92933	50
11	95928	91049	96162	91541	96388	92020	96608	92487	96821	92941	49
12	95932	91057	96165	91549	96392	92028	96612	92495	96824	92948	48
13	95936	91066	96169	91557	96396	92036	96615	92502	96827	92955	47
14	95939	91074	96173	91565	96400	92044	96619	92510	96831	92963	46
15	9.95943	0.91082	9.96177	0.91573	9.96403	0.92052	9.96622	0.92518	9.96834	0.92970	45
16	95947	91091	96181	91582	96407	92060	96626	92525	96837	92978	44
17	95951	91099	96185	91590	96411	92068	96630	92533	96841	92985	43
18	95955	91107	96188	91598	96414	92076	96633	92541	96845	92993	42
19	95959	91115	96192	91606	96418	92083	96637	92548	96848	93000	41
20	9.95963	0.91124	9.96196	0.91614	9.96422	0.92091	9.96640	0.92556	9.96852	0.93007	40
21	95967	91132	96200	91622	96426	92099	96644	92563	96855	93015	39
22	95971	91140	96204	91630	96429	92107	96648	92571	96859	93022	38
23	95975	91149	96208	91638	96433	92115	96651	92579	96862	93030	37
24	95979	91157	96211	91646	96437	92123	96655	92586	96866	93037	36
25	9.95983	0.91165	9.96215	0.91654	9.96440	0.92130	9.96658	0.92594	9.96869	0.93045	35
26	95987	91173	96219	91662	96444	92138	96662	92602	96873	93052	34
27	95991	91182	96223	91670	96448	92146	96665	92609	96876	93059	33
28	95995	91190	96227	91678	96451	92154	96669	92617	96879	93067	32
29	95999	91198	96230	91686	96455	92162	96673	92624	96883	93074	31
30	9.96002	0.91206	9.96234	0.91694	9.96459	0.92170	9.96676	0.92632	9.96886	0.93081	30
31	96006	91215	96238	91702	96462	92177	96680	92640	96890	93089	29
32	96010	91223	96242	91710	96466	92185	96683	92647	96894	93096	28
33	96014	91231	96246	91718	96470	92193	96687	92655	96897	93104	27
34	96018	91239	96249	91726	96473	92201	96690	92662	96900	93111	26
35	9.96022	0.91247	9.96253	0.91734	9.96477	0.92209	9.96694	0.92670	9.96904	0.93118	25
36	96026	91256	96257	91742	96481	92216	96697	92678	96907	93126	24
37	96030	91264	96261	91750	96484	92224	96701	92685	96910	93133	23
38	96034	91272	96265	91758	96488	92232	96705	92693	96914	93140	22
39	96038	91280	96268	91766	96492	92240	96708	92700	96917	93148	21
40	9.96042	0.91289	9.96272	0.91774	9.96495	0.92248	9.96712	0.92708	9.96921	0.93155	20
41	96046	91297	96276	91782	96499	92255	96715	92715	96924	93162	19
42	96049	91305	96280	91790	96503	92263	96719	92723	96928	93170	18
43	96053	91313	96283	91798	96506	92271	96722	92730	96931	93177	17
44	96057	91321	96287	91806	96510	92279	96726	92738	96934	93184	16
45	9.96061	0.91329	9.96291	0.91814	9.96514	0.92286	9.96729	0.92746	9.96938	0.93192	15
46	96065	91338	96295	91822	96517	92294	96733	92753	96941	93199	14
47	96069	91346	96299	91830	96521	92302	96736	92761	96945	93206	13
48	96073	91354	96302	91838	96525	92310	96740	92768	96948	93214	12
49	96077	91362	96306	91846	96528	92317	96743	92776	96951	93221	11
50	9.96081	0.91370	9.96310	0.91854	9.96532	0.92325	9.96747	0.92783	9.96955	0.93228	10
51	96084	91379	96314	91862	96536	92333	96750	92791	96958	93236	9
52	96088	91387	96317	91870	96539	92341	96754	92798	96962	93243	8
53	96092	91395	96321	91878	96543	92348	96758	92806	96965	93250	7
54	96096	91403	96325	91886	96547	92356	96761	92813	96968	93258	6
55	9.96100	0.91411	9.96329	0.91894	9.96550	0.92361	9.96765	0.92821	9.96972	0.93265	5
56	96104	91419	96332	91902	96554	92372	96768	92828	96975	93272	4
57	96108	91427	96336	91910	96557	92379	96772	92836	96979	93279	3
58	96112	91436	96340	91918	96561	92387	96775	92843	96982	93287	2
59	96115	91444	96344	91926	96565	92395	96779	92851	96985	93294	1
60	9.96119	0.91452	9.96347	0.91934	9.96568	0.92402	9.96782	0.92858	9.96989	0.93301	0
	214°		213°		212°		211°		210°		

Haversines

	150°		151°		152°		153°		154°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.96989	0.93301	9.97188	0.93731	9.97381	0.94147	9.97566	0.94550	9.97745	0.94940	60
1	.96992	.93309	.97192	.93738	.97384	.94154	.97569	.94557	.97748	.94946	59
2	.96996	.93316	.97195	.93745	.97387	.94161	.97572	.94564	.97751	.94952	58
3	.96999	.93323	.97198	.93752	.97390	.94168	.97575	.94570	.97754	.94959	57
4	.97002	.93330	.97201	.93759	.97393	.94175	.97578	.94577	.97756	.94965	56
5	9.97006	0.93338	9.97205	0.93766	9.97397	0.94181	9.97581	0.94583	9.97759	0.94972	55
6	.97009	.93345	.97208	.93773	.97400	.94188	.97584	.94590	.97762	.94978	54
7	.97012	.93352	.97211	.93780	.97403	.94195	.97587	.94596	.97765	.94984	53
8	.97016	.93359	.97214	.93787	.97406	.94202	.97591	.94603	.97768	.94991	52
9	.97019	.93367	.97218	.93794	.97409	.94209	.97594	.94610	.97771	.94997	51
10	9.97022	0.93374	9.97221	0.93801	9.97412	0.94215	9.97597	0.94616	9.97774	0.95003	50
11	.97026	.93381	.97224	.93808	.97415	.94222	.97600	.94623	.97777	.95010	49
12	.97029	.93388	.97227	.93815	.97418	.94229	.97603	.94629	.97780	.95016	48
13	.97033	.93395	.97231	.93822	.97422	.94236	.97606	.94636	.97783	.95022	47
14	.97036	.93403	.97234	.93829	.97425	.94243	.97609	.94642	.97785	.95029	46
15	9.97039	0.93410	9.97237	0.93836	9.97428	0.94249	9.97612	0.94649	9.97788	0.95035	45
16	.97043	.93417	.97240	.93843	.97431	.94256	.97615	.94655	.97791	.95041	44
17	.97046	.93424	.97244	.93850	.97434	.94263	.97618	.94662	.97794	.95048	43
18	.97049	.93432	.97247	.93857	.97437	.94270	.97621	.94669	.97797	.95054	
19	.97052	.93439	.97250	.93864	.97440	.94276	.97624	.94675	.97800	.95060	
20	9.97056	0.93446	9.97253	0.93871	9.97443	0.94283	9.97627	0.94682	9.97803	0.95066	40
21	.97059	.93453	.97257	.93878	.97447	.94290	.97630	.94688	.97806	.95073	39
22	.97063	.93460	.97260	.93885	.97450	.94297	.97633	.94695	.97808	.95079	38
23	.97066	.93468	.97263	.93892	.97453	.94303	.97636	.94701	.97811	.95085	37
24	.97069	.93475	.97266	.93899	.97456	.94310	.97639	.94708	.97814	.95092	36
25	9.97073	0.93482	9.97269	0.93906	9.97459	0.94317	9.97642	0.94714	9.97817	0.95098	35
26	.97076	.93489	.97273	.93913	.97462	.94324	.97645	.94721	.97820	.95104	34
27	.97079	.93496	.97276	.93920	.97465	.94330	.97647	.94727	.97823	.95110	33
28	.97083	.93503	.97279	.93927	.97468	.94337	.97650	.94734	.97826	.95117	32
29	.97086	.93511	.97282	.93934	.97471	.94344	.97653	.94740	.97829	.95123	31
30	9.97089	0.93518	9.97285	0.93941	9.97474	0.94351	9.97656	0.94747	9.97831	0.95129	30
31	.97093	.93525	.97289	.93948	.97478	.94357	.97659	.94753	.97834	.95136	29
32	.97096	.93532	.97292	.93955	.97481	.94364	.97662	.94760	.97837	.95142	28
33	.97099	.93539	.97295	.93962	.97484	.94371	.97665	.94766	.97840	.95148	27
34	.97103	.93546	.97298	.93969	.97487	.94377	.97668	.94773	.97843	.95154	26
35	9.97106	0.93554	9.97301	0.93976	9.97490	0.94384	9.97671	0.94779	9.97846	0.95161	25
36	.97109	.93561	.97305	.93982	.97493	.94391	.97674	.94786	.97849	.95167	24
37	.97113	.93568	.97308	.93989	.97496	.94397	.97677	.94792	.97851	.95173	23
38	.97116	.93575	.97311	.93996	.97499	.94404	.97680	.94799	.97854	.95179	22
39	.97119	.93582	.97314	.94003	.97502	.94411	.97683	.94805	.97857	.95185	21
40	9.97123	0.93589	9.97317	0.94010	9.97505	0.94418	9.97686	0.94811	9.97860	0.95192	20
41	.97126	.93596	.97321	.94017	.97508	.94424	.97689	.94818	.97863	.95198	19
42	.97129	.93603	.97324	.94024	.97511	.94431	.97692	.94824	.97866	.95204	
43	.97132	.93611	.97327	.94031	.97514	.94438	.97695	.94831	.97868	.95210	
44	.97136	.93618	.97330	.94038	.97518	.94444	.97698	.94837	.97871	.95217	16
45	9.97139	0.93625	9.97333	0.94045	9.97521	0.94451	9.97701	0.94844	9.97874	0.95223	15
46	.97142	.93632	.97337	.94051	.97524	.94458	.97704	.94850	.97877	.95229	14
47	.97146	.93639	.97340	.94058	.97527	.94464	.97707	.94856	.97880	.95235	13
48	.97149	.93646	.97343	.94065	.97530	.94471	.97710	.94863	.97883	.95241	12
49	.97152	.93653	.97346	.94072	.97533	.94477	.97713	.94869	.97885	.95248	11
50	9.97156	0.93660	9.97349	0.94079	9.97536	0.94484	9.97716	0.94876	9.97888	0.95254	10
51	.97159	.93667	.97352	.94086	.97539	.94491	.97718	.94882	.97891	.95260	9
52	.97162	.93674	.97356	.94093	.97542	.94497	.97721	.94889	.97894	.95266	8
53	.97165	.93682	.97359	.94099	.97545	.94504	.97724	.94895	.97897	.95272	7
54	.97169	.93689	.97362	.94106	.97548	.94511	.97727	.94901	.97899	.95278	6
55	9.97172	0.93696	9.97365	0.94113	9.97551	0.94517	9.97730	0.94908	9.97902	0.95285	5
56	.97175	.93703	.97368	.94120	.97554	.94524	.97733	.94914	.97905	.95291	4
57	.97179	.93710	.97371	.94127	.97557	.94531	.97736	.94921	.97908	.95297	3
58	.97182	.93717	.97375	.94134	.97560	.94537	.97739	.94927	.97911	.95303	2
59	.97185	.93724	.97378	.94141	.97563	.94544	.97742	.94933	.97914	.95309	1
60	9.97188	0.93731	9.97381	0.94147	9.97566	0.94550	9.97745	0.94940	9.97916	0.95315	0
	209°		208°		207°		206°		205°		

2

Haversines

	155°		156°		157°		158°		159°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9. 97916	0. 95315	9. 98081	0. 95677	9. 98239	0. 96025	9. 98389	0. 96359	9. 98533	0. 96679	60
1	97919	95322	98084	95683	98241	96031	98392	96365	98536	96684	59
2	97922	95328	98086	95689	98244	96037	98394	96370	98538	96689	58
3	97925	95334	98089	95695	98246	96042	98397	96376	98540	96695	57
4	97927	95340	98092	95701	98249	96048	98399	96381	98543	96700	56
5	97930	95346	98094	95707	98251	96054	98402	96386	98545	96705	55
6	97933	95352	98097	95713	98254	96059	98404	96392	98547	96710	54
7	97936	95358	98100	95719	98256	96065	98406	96397	98550	96715	53
8	97939	95364	98102	95724	98259	96071	98409	96403	98552	96721	52
9	97941	95371	98105	95730	98262	96076	98411	96408	98554	96726	51
10	97944	95377	98108	95736	98264	96082	98414	96413	98557	96731	50
11	97947	95383	98110	95742	98267	96088	98416	96419	98559	96736	49
12	97950	95389	98113	95748	98269	96093	98419	96424	98561	96741	48
13	97953	95395	98116	95754	98272	96099	98421	96430	98564	96746	47
14	97955	95401	98118	95760	98274	96104	98424	96435	98566	96752	46
15	97958	95407	98121	95766	98277	96110	98426	96440	98568	96757	45
16	97961	95413	98124	95771	98279	96116	98428	96446	98570	96762	44
17	97964	95419	98126	95777	98282	96121	98431	96451	98573	96767	43
18	97966	95425	98129	95783	98285	96127	98433	96457	98575	96772	42
19	97969	95431	98132	95789	98287	96133	98436	96462	98577	96777	41
20	97972	95438	98134	95795	98290	96138	98438	96467	98580	96782	40
21	97975	95444	98137	95801	98292	96144	98440	96473	98582	96788	39
22	97977	95450	98139	95806	98295	96149	98443	96478	98584	96793	38
23	97980	95456	98142	95812	98297	96155	98445	96483	98587	96798	37
24	97983	95462	98145	95818	98300	96161	98448	96489	98589	96803	36
25	97986	95468	98147	95824	98302	96166	98450	96494	98591	96808	35
26	97988	95474	98150	95830	98305	96172	98453	96500	98593	96813	34
27	97991	95480	98153	95836	98307	96177	98455	96505	98596	96818	33
28	97994	95486	98155	95841	98310	96183	98457	96510	98598	96823	32
29	97997	95492	98158	95847	98312	96188	98460	96516	98600	96829	31
30	97999	95498	98161	95853	98315	96194	98462	96521	98603	96834	30
31	98002	95504	98163	95859	98317	96200	98465	96526	98605	96839	29
32	98005	95510	98166	95865	98320	96205	98467	96532	98607	96844	28
33	98008	95516	98168	95870	98322	96211	98469	96537	98609	96849	27
34	98010	95522	98171	95876	98325	96216	98472	96542	98612	96854	26
35	98013	95528	98174	95882	98327	96222	98474	96547	98614	96859	25
36	98016	95534	98176	95888	98330	96227	98476	96553	98616	96864	24
37	98019	95540	98179	95894	98332	96233	98479	96558	98619	96869	23
38	98021	95546	98182	95899	98335	96238	98481	96563	98621	96874	22
39	98024	95552	98184	95905	98337	96244	98484	96569	98623	96879	21
40	98027	95558	98187	95911	98340	96249	98486	96574	98625	96884	20
41	98030	95564	98189	95917	98342	96255	98488	96579	98628	96889	19
42	98032	95570	98192	95922	98345	96260	98491	96585	98630	96894	18
43	98035	95576	98195	95928	98347	96266	98493	96590	98632	96899	17
44	98038	95582	98197	95934	98350	96272	98496	96595	98634	96905	16
45	98040	95588	98200	95940	98352	96277	98498	96600	98637	96910	15
46	98043	95594	98202	95945	98355	96283	98500	96606	98639	96915	14
47	98046	95600	98205	95951	98357	96288	98503	96611	98641	96920	13
48	98049	95606	98208	95957	98360	96294	98505	96616	98643	96925	12
49	98051	95612	98210	95962	98362	96299	98507	96621	98646	96930	11
50	98054	95618	98213	95968	98365	96305	98510	96627	98648	96935	10
51	98057	95624	98215	95974	98367	96310	98512	96632	98650	96940	9
52	98059	95630	98218	95980	98370	96315	98514	96637	98652	96945	8
53	98062	95636	98221	95985	98372	96321	98517	96642	98655	96950	7
54	98065	95642	98223	95991	98375	96326	98519	96648	98657	96955	6
55	98067	95648	98226	95997	98377	96332	98521	96653	98659	96960	5
56	98070	95654	98228	96002	98379	96337	98524	96658	98661	96965	4
57	98073	95660	98231	96008	98382	96343	98526	96663	98664	96970	3
58	98076	95665	98233	96014	98384	96348	98529	96669	98668	96975	2
59	98078	95671	98236	96020	98387	96354	98531	96674	98668	96980	1
60	98081	95677	98239	96025	98389	96359	98533	96679	98670	96985	0
204°		203°		202°		201°		200°			

Haversines

	160°		161°		162°		163°		164°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9. 98670	0. 96985	9. 98801	0. 97276	9. 98924	0. 97553	9. 99041	0. 97815	9. 99151	0. 98063	60
1	98673	96990	98803	97281	98926	97557	99043	97819	99152	98067	59
2	98675	96995	98805	97285	98928	97562	99044	97824	99154	98071	58
3	98677	97000	98807	97290	98930	97566	99046	97828	99156	98075	57
4	98679	97004	98809	97295	98932	97571	99048	97832	99158	98079	56
5	9. 98681	0. 97009	9. 98811	0. 97300	9. 98934	0. 97575	9. 99050	0. 97836	9. 99159	0. 98083	55
6	98684	97014	98813	97304	98936	97580	99052	97841	99161	98087	54
7	98686	97019	98815	97309	98938	97584	99054	97845	99163	98091	53
8	98688	97024	98817	97314	98940	97589	99056	97849	99165	98095	52
9	98690	97029	98819	97318	98942	97593	99058	97853	99166	98099	51
10	9. 98692	0. 97034	9. 98822	0. 97323	9. 98944	0. 97598	9. 99059	0. 97858	9. 99168	0. 98103	50
11	98695	97039	98824	97328	98946	97602	99061	97862	99170	98107	49
12	98697	97044	98826	97332	98948	97606	99063	97866	99172	98111	48
13	98699	97049	98828	97337	98950	97611	99065	97870	99173	98115	47
14	98701	97054	98830	97342	98952	97615	99067	97874	99175	98119	46
15	9. 98703	0. 97059	9. 98832	0. 97347	9. 98954	0. 97620	9. 99069	0. 97879	9. 99177	0. 98123	45
16	98706	97064	98834	97351	98956	97624	99071	97883	99179	98127	44
17	98708	97069	98836	97356	98958	97629	99072	97887	99180	98131	43
18	98710	97074	98838	97361	98960	97633	99074	97891	99182	98135	42
19	98712	97078	98840	97365	98962	97637	99076	97895	99184	98139	41
20	9. 98714	0. 97083	9. 98842	0. 97370	9. 98964	0. 97642	9. 99078	0. 97899	9. 99186	0. 98142	40
21	98717	97088	98845	97374	98966	97646	99080	97904	99187	98146	39
22	98719	97093	98847	97379	98968	97651	99082	97908	99189	98150	38
23	98721	97098	98849	97384	98970	97655	99084	97912	99191	98154	37
24	98723	97103	98851	97388	98971	97660	99085	97916	99193	98158	36
25	9. 98725	0. 97108	9. 98853	0. 97393	9. 98973	0. 97664	9. 99087	0. 97920	9. 99194	0. 98162	35
26	98728	97113	98855	97398	98975	97668	99089	97924	99196	98166	34
27	98730	97117	98857	97402	98977	97673	99091	97929	99198	98170	33
28	98732	97122	98859	97407	98979	97677	99093	97933	99200	98174	32
29	98734	97127	98861	97412	98981	97681	99095	97937	99201	98178	31
30	9. 98736	0. 97132	9. 98863	0. 97416	9. 98983	0. 97686	9. 99096	0. 97941	9. 99203	0. 98182	30
31	98738	97137	98865	97421	98985	97690	99098	97945	99205	98185	29
32	98741	97142	98867	97425	98987	97695	99100	97949	99206	98189	28
33	98743	97147	98869	97430	98989	97699	99102	97953	99208	98193	27
34	98745	97151	98871	97435	98991	97703	99104	97957	99210	98197	26
35	9. 98747	0. 97156	9. 98873	0. 97439	9. 98993	0. 97708	9. 99106	0. 97962	9. 99212	0. 98201	25
36	98749	97161	98875	97444	98995	97712	99107	97966	99213	98205	24
37	98751	97166	98877	97448	98997	97716	99109	97970	99215	98209	23
38	98754	97171	98880	97453	98999	97721	99111	97974	99217	98212	22
39	98756	97176	98882	97458	99001	97725	99113	97978	99218	98216	21
40	9. 98758	0. 97180	9. 98884	0. 97462	9. 99003	0. 97729	9. 99115	0. 97982	9. 99220	0. 98220	20
41	98760	97185	98886	97467	99004	97734	99116	97986	99222	98224	19
42	98762	97190	98888	97471	99006	97738	99118	97990	99223	98228	18
43	98764	97195	98890	97476	99008	97742	99120	97994	99225	98232	17
44	98766	97200	98892	97480	99010	97747	99122	97998	99227	98236	16
45	9. 98769	0. 97204	9. 98894	0. 97485	9. 99012	0. 97751	9. 99124	0. 98002	9. 99229	0. 98239	15
46	98771	97209	98896	97490	99014	97755	99126	98007	99230	98243	14
47	98773	97214	98898	97494	99016	97760	99127	98011	99232	98247	13
48	98775	97219	98900	97499	99018	97764	99129	98015	99234	98251	12
49	98777	97224	98902	97503	99020	97768	99131	98019	99235	98255	11
50	9. 98779	0. 97228	9. 98904	0. 97508	9. 99022	0. 97773	9. 99133	0. 98023	9. 99237	0. 98258	10
51	98781	97233	98906	97512	99024	97777	99135	98027	99239	98262	9
52	98784	97238	98908	97517	99026	97781	99136	98031	99240	98266	8
53	98786	97243	98910	97521	99027	97785	99138	98035	99242	98270	7
54	98788	97247	98912	97526	99029	97790	99140	98039	99244	98274	6
55	9. 98790	0. 97252	9. 98914	0. 97530	9. 99031	0. 97794	9. 99142	0. 98043	9. 99245	0. 98277	5
56	98792	97257	98916	97535	99033	97798	99143	98047	99247	98281	4
57	98794	97262	98918	97539	99035	97802	99145	98051	99249	98285	3
58	98796	97266	98920	97544	99037	97807	99147	98055	99250	98289	2
59	98798	97271	98922	97548	99039	97811	99149	98059	99252	98293	1
60	9. 98801	0. 97276	9. 98924	0. 97553	9. 99041	0. 97815	9. 99151	0. 98063	9. 99254	0. 98296	0
	159°		158°		157°		156°		155°		

2

Haversines

	165°		166°		167°		168°		169°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.99254	0.98296	9.99350	0.98515	9.99440	0.98719	9.99523	0.98907	9.99599	0.99081	60
1	.99255	.98300	.99352	.98518	.99441	.98722	.99524	.98910	.99600	.99084	59
2	.99257	.98304	.99353	.98522	.99443	.98725	.99526	.98913	.99602	.99087	58
3	.99259	.98308	.99355	.98525	.99444	.98728	.99527	.98916	.99603	.99090	57
4	.99260	.98311	.99356	.98529	.99446	.98732	.99528	.98919	.99604	.99092	56
5	9.99262	0.98315	9.99358	0.98532	9.99447	0.98735	9.99529	0.98922	9.99605	0.99095	55
6	.99264	.98319	.99359	.98536	.99448	.98738	.99531	.98925	.99606	.99098	54
7	.99265	.98323	.99361	.98539	.99450	.98741	.99532	.98928	.99608	.99101	53
8	.99267	.98326	.99362	.98543	.99451	.98745	.99533	.98931	.99609	.99103	52
9	.99269	.98330	.99364	.98546	.99453	.98748	.99535	.98934	.99610	.99106	51
10	9.99270	0.98334	9.99366	0.98550	9.99454	0.98751	9.99536	0.98937	9.99611	0.99109	50
11	.99272	.98337	.99367	.98553	.99456	.98754	.99537	.98940	.99612	.99112	49
12	.99274	.98341	.99369	.98557	.99457	.98757	.99539	.98943	.99614	.99114	48
13	.99275	.98345	.99370	.98560	.99458	.98761	.99540	.98946	.99615	.99117	47
14	.99277	.98349	.99372	.98564	.99460	.98764	.99541	.98949	.99616	.99120	46
15	9.99278	0.98352	9.99373	0.98567	9.99461	0.98767	9.99543	0.98952	9.99617	0.99123	45
16	.99280	.98356	.99375	.98571	.99463	.98770	.99544	.98955	.99618	.99125	44
17	.99282	.98360	.99376	.98574	.99464	.98774	.99545	.98958	.99620	.99128	43
18	.99283	.98363	.99378	.98577	.99465	.98777	.99546	.98961	.99621	.99131	42
19	.99285	.98367	.99379	.98581	.99467	.98780	.99548	.98964	.99622	.99133	41
20	9.99287	0.98371	9.99381	0.98584	9.99468	0.98783	9.99549	0.98967	9.99623	0.99136	40
21	.99288	.98374	.99382	.98588	.99470	.98786	.99550	.98970	.99624	.99139	39
22	.99290	.98378	.99384	.98591	.99471	.98789	.99552	.98973	.99626	.99141	38
23	.99291	.98382	.99385	.98595	.99472	.98793	.99553	.98976	.99627	.99144	37
24	.99293	.98385	.99387	.98598	.99474	.98796	.99554	.98979	.99628	.99147	36
25	9.99295	0.98389	9.99388	0.98601	9.99475	0.98799	9.99555	0.98982	9.99629	0.99149	35
26	.99296	.98393	.99390	.98605	.99477	.98802	.99557	.98985	.99630	.99152	34
27	.99298	.98396	.99391	.98608	.99478	.98805	.99558	.98988	.99631	.99155	33
28	.99300	.98400	.99393	.98612	.99479	.98808	.99559	.98990	.99633	.99157	32
29	.99301	.98404	.99394	.98615	.99481	.98812	.99561	.98993	.99634	.99160	31
30	9.99303	0.98407	9.99396	0.98618	9.99482	0.98815	9.99562	0.98996	9.99635	0.99163	30
31	.99304	.98411	.99397	.98622	.99484	.98818	.99563	.98999	.99636	.99165	29
32	.99306	.98415	.99399	.98625	.99485	.98821	.99564	.99002	.99637	.99168	28
33	.99308	.98418	.99400	.98629	.99486	.98824	.99566	.99005	.99638	.99171	27
34	.99309	.98422	.99402	.98632	.99488	.98827	.99567	.99008	.99639	.99173	26
35	9.99311	0.98426	9.99403	0.98635	9.99489	0.98830	9.99568	0.99011	9.99641	0.99176	25
36	.99312	.98429	.99405	.98639	.99490	.98834	.99569	.99014	.99642	.99179	24
37	.99314	.98433	.99406	.98642	.99492	.98837	.99571	.99016	.99643	.99181	23
38	.99316	.98436	.99408	.98646	.99493	.98840	.99572	.99019	.99644	.99184	22
39	.99317	.98440	.99409	.98649	.99495	.98843	.99573	.99022	.99645	.99186	21
40	9.99319	0.98444	9.99411	0.98652	9.99496	0.98846	9.99575	0.99025	9.99646	0.99189	20
41	.99320	.98447	.99412	.98656	.99497	.98849	.99576	.99028	.99648	.99192	19
42	.99322	.98451	.99414	.98659	.99499	.98852	.99577	.99031	.99649	.99194	18
43	.99324	.98454	.99415	.98662	.99500	.98855	.99578	.99034	.99650	.99197	17
44	.99325	.98458	.99417	.98666	.99501	.98858	.99580	.99036	.99651	.99199	16
45	9.99327	0.98462	9.99418	0.98669	9.99503	0.98862	9.99581	0.99039	9.99652	0.99202	15
46	.99328	.98465	.99420	.98672	.99504	.98865	.99582	.99042	.99653	.99205	14
47	.99330	.98469	.99421	.98676	.99505	.98868	.99583	.99045	.99654	.99207	13
48	.99331	.98472	.99422	.98679	.99507	.98871	.99584	.99048	.99655	.99210	12
49	.99333	.98476	.99424	.98682	.99508	.98874	.99586	.99051	.99657	.99212	11
50	9.99335	0.98479	9.99425	0.98686	9.99510	0.98877	9.99587	0.99053	9.99658	0.99215	10
51	.99336	.98483	.99427	.98689	.99511	.98880	.99588	.99056	.99659	.99217	9
52	.99338	.98487	.99429	.98692	.99512	.98883	.99589	.99059	.99660	.99220	8
53	.99339	.98490	.99430	.98695	.99514	.98886	.99591	.99062	.99661	.99223	7
54	.99341	.98494	.99431	.98699	.99515	.98889	.99592	.99065	.99662	.99225	6
55	9.99342	0.98497	9.99433	0.98702	9.99516	0.98892	9.99593	0.99067	9.99663	0.99228	5
56	.99344	.98501	.99434	.98705	.99518	.98895	.99594	.99070	.99664	.99230	4
57	.99345	.98504	.99436	.98709	.99519	.98898	.99596	.99073	.99666	.99233	3
58	.99347	.98508	.99437	.98712	.99520	.98901	.99597	.99076	.99667	.99235	2
59	.99349	.98511	.99438	.98715	.99522	.98904	.99598	.99079	.99668	.99238	1
60	9.99350	0.98515	9.99440	0.98719	9.99523	0.98907	9.99599	0.99081	9.99669	0.99240	0
	194°		193°		192°		191°		190°		

Haversines

	170°		171°		172°		173°		174°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.99669	0.99240	9.99732	0.99384	9.99788	0.99513	9.99838	0.99627	9.99881	0.99726	60
1	.99670	.99243	.99733	.99387	.99789	.99515	.99839	.99629	.99882	.99728	59
2	.99671	.99245	.99734	.99389	.99790	.99517	.99839	.99631	.99882	.99729	58
3	.99672	.99248	.99735	.99391	.99791	.99519	.99840	.99633	.99883	.99731	57
4	.99673	.99250	.99736	.99393	.99792	.99521	.99841	.99634	.99884	.99732	56
5	9.99674	0.99253	9.99737	0.99396	9.99793	0.99523	9.99842	0.99636	9.99884	0.99734	55
6	.99675	.99255	.99738	.99398	.99793	.99525	.99842	.99638	.99885	.99735	54
7	.99677	.99258	.99739	.99400	.99794	.99527	.99843	.99640	.99885	.99737	53
8	.99678	.99260	.99740	.99402	.99795	.99529	.99844	.99641	.99886	.99738	52
9	.99679	.99263	.99741	.99405	.99796	.99531	.99845	.99643	.99887	.99740	51
10	9.99680	0.99265	9.99742	0.99407	9.99797	0.99533	9.99845	0.99645	9.99887	0.99741	50
11	.99681	.99268	.99743	.99409	.99798	.99535	.99846	.99647	.99888	.99743	49
12	.99682	.99270	.99744	.99411	.99799	.99537	.99847	.99648	.99889	.99744	48
13	.99683	.99273	.99745	.99414	.99800	.99539	.99848	.99650	.99889	.99746	47
14	.99684	.99275	.99746	.99416	.99800	.99541	.99848	.99652	.99890	.99747	46
15	9.99685	0.99278	9.99747	0.99418	9.99801	0.99543	9.99849	0.99653	9.99891	0.99748	45
16	.99686	.99280	.99748	.99420	.99802	.99545	.99850	.99655	.99891	.99750	44
17	.99687	.99283	.99748	.99422	.99803	.99547	.99851	.99657	.99892	.99751	43
18	.99688	.99285	.99749	.99425	.99804	.99549	.99851	.99659	.99893	.99753	42
19	.99690	.99288	.99750	.99427	.99805	.99551	.99852	.99660	.99893	.99754	41
20	9.99691	0.99290	9.99751	0.99429	9.99805	0.99553	9.99853	0.99662	9.99894	0.99756	40
21	.99692	.99293	.99752	.99431	.99806	.99555	.99854	.99664	.99894	.99757	39
22	.99693	.99295	.99753	.99433	.99807	.99557	.99854	.99665	.99895	.99759	38
23	.99694	.99297	.99754	.99436	.99808	.99559	.99855	.99667	.99896	.99760	37
24	.99695	.99300	.99755	.99438	.99809	.99561	.99856	.99669	.99896	.99761	36
25	9.99696	0.99302	9.99756	0.99440	9.99810	0.99563	9.99857	0.99670	9.99897	0.99763	35
26	.99697	.99305	.99757	.99442	.99811	.99565	.99857	.99672	.99897	.99764	34
27	.99698	.99307	.99758	.99444	.99811	.99567	.99858	.99674	.99898	.99766	33
28	.99699	.99309	.99759	.99446	.99812	.99568	.99859	.99675	.99899	.99767	32
29	.99700	.99312	.99760	.99449	.99813	.99570	.99859	.99677	.99899	.99768	31
30	9.99701	0.99314	9.99761	0.99451	9.99814	0.99572	9.99860	0.99679	9.99900	0.99770	30
31	.99702	.99317	.99762	.99453	.99815	.99574	.99861	.99680	.99901	.99771	29
32	.99703	.99319	.99763	.99455	.99815	.99576	.99862	.99682	.99901	.99773	28
33	.99704	.99321	.99764	.99457	.99816	.99578	.99862	.99684	.99902	.99774	27
34	.99705	.99324	.99765	.99459	.99817	.99580	.99863	.99685	.99902	.99775	26
35	9.99706	0.99326	9.99766	0.99461	9.99818	0.99582	9.99864	0.99687	9.99903	0.99777	25
36	.99707	.99329	.99766	.99464	.99819	.99584	.99864	.99688	.99904	.99778	24
37	.99708	.99331	.99767	.99466	.99820	.99585	.99865	.99690	.99904	.99779	23
38	.99710	.99333	.99768	.99468	.99820	.99587	.99866	.99692	.99905	.99781	22
39	.99711	.99336	.99769	.99470	.99821	.99589	.99867	.99693	.99905	.99782	21
40	9.99712	0.99338	9.99770	0.99472	9.99822	0.99591	9.99867	0.99695	9.99906	0.99784	20
41	.99713	.99340	.99771	.99474	.99823	.99593	.99868	.99696	.99906	.99785	19
42	.99714	.99343	.99772	.99476	.99824	.99595	.99869	.99698	.99907	.99786	18
43	.99715	.99345	.99773	.99478	.99824	.99597	.99869	.99700	.99908	.99788	17
44	.99716	.99347	.99774	.99480	.99825	.99598	.99870	.99701	.99908	.99789	16
45	9.99717	0.99350	9.99774	0.99483	9.99826	0.99600	9.99871	0.99703	9.99909	0.99790	15
46	.99718	.99352	.99775	.99485	.99827	.99602	.99871	.99704	.99909	.99792	14
47	.99719	.99354	.99776	.99487	.99828	.99604	.99872	.99706	.99910	.99793	13
48	.99720	.99357	.99777	.99489	.99828	.99606	.99873	.99708	.99911	.99794	12
49	.99721	.99359	.99778	.99491	.99829	.99608	.99874	.99709	.99911	.99796	11
50	9.99722	0.99361	9.99779	0.99493	9.99830	0.99609	9.99874	0.99711	9.99912	0.99797	10
51	.99723	.99364	.99780	.99495	.99831	.99611	.99875	.99712	.99912	.99798	9
52	.99724	.99366	.99781	.99497	.99832	.99613	.99876	.99714	.99913	.99799	8
53	.99725	.99368	.99782	.99499	.99832	.99615	.99876	.99715	.99913	.99801	7
54	.99726	.99371	.99783	.99501	.99833	.99617	.99877	.99717	.99914	.99802	6
55	9.99727	0.99373	9.99784	0.99503	9.99834	0.99618	9.99878	0.99718	9.99915	0.99803	5
56	.99728	.99375	.99785	.99505	.99835	.99620	.99878	.99720	.99915	.99805	4
57	.99729	.99378	.99786	.99507	.99836	.99622	.99879	.99722	.99916	.99806	3
58	.99730	.99380	.99786	.99509	.99836	.99624	.99880	.99723	.99916	.99807	2
59	.99731	.99382	.99787	.99511	.99837	.99626	.99880	.99725	.99917	.99808	1
60	9.99732	0.99384	9.99788	0.99513	9.99838	0.99627	9.99881	0.99726	9.99917	0.99810	0
	189°		188°		187°		186°		185°		

2

Haversines

	175°		176°		177°		178°		179°		
	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	Log Hav	Nat. Hav	
0	9.99917	0.99810	9.99947	0.99878	9.99970	0.99931	9.99987	0.99970	9.99997	0.99992	60
1	.99918	.99811	.99948	.99879	.99971	.99932	.99987	.99970	.99997	.99993	59
2	.99918	.99812	.99948	.99880	.99971	.99933	.99987	.99971	.99997	.99993	58
3	.99919	.99814	.99948	.99881	.99971	.99934	.99987	.99971	.99997	.99993	57
4	.99919	.99815	.99949	.99882	.99972	.99934	.99988	.99972	.99997	.99993	56
5	9.99920	0.99816	9.99949	0.99883	9.99972	0.99935	9.99988	0.99972	9.99997	0.99994	55
6	.99921	.99817	.99950	.99884	.99972	.99936	.99988	.99973	.99997	.99994	54
7	.99921	.99819	.99950	.99885	.99973	.99937	.99988	.99973	.99997	.99994	53
8	.99922	.99820	.99951	.99886	.99973	.99937	.99988	.99973	.99998	.99994	52
9	.99922	.99821	.99951	.99887	.99973	.99938	.99989	.99974	.99998	.99994	51
10	9.99923	0.99822	9.99951	0.99888	9.99973	0.99939	9.99989	0.99974	9.99998	0.99995	50
11	.99923	.99823	.99952	.99889	.99974	.99940	.99989	.99975	.99998	.99995	49
12	.99924	.99825	.99952	.99890	.99974	.99940	.99989	.99975	.99998	.99995	48
13	.99924	.99826	.99953	.99891	.99974	.99941	.99989	.99976	.99998	.99995	47
14	.99925	.99827	.99953	.99892	.99975	.99942	.99990	.99976	.99998	.99996	46
15	9.99925	0.99828	9.99953	0.99893	9.99975	0.99942	9.99990	0.99977	9.99998	0.99996	45
16	.99926	.99829	.99954	.99894	.99975	.99943	.99990	.99977	.99998	.99996	44
17	.99926	.99831	.99954	.99895	.99976	.99944	.99990	.99978	.99998	.99996	43
18	.99927	.99832	.99954	.99896	.99976	.99944	.99990	.99978	.99998	.99996	42
19	.99927	.99833	.99955	.99897	.99976	.99945	.99991	.99978	.99998	.99996	41
20	9.99928	0.99834	9.99955	0.99898	9.99976	0.99946	9.99991	0.99979	9.99999	0.99997	40
21	.99928	.99835	.99956	.99899	.99977	.99947	.99991	.99979	.99999	.99997	39
22	.99929	.99837	.99956	.99900	.99977	.99947	.99991	.99980	.99999	.99997	38
23	.99929	.99838	.99957	.99900	.99977	.99948	.99991	.99980	.99999	.99997	37
24	.99930	.99839	.99957	.99901	.99978	.99949	.99992	.99981	.99999	.99997	36
25	9.99931	0.99840	9.99958	0.99902	9.99978	0.99949	9.99992	0.99981	9.99999	0.99997	35
26	.99931	.99841	.99958	.99903	.99978	.99950	.99992	.99981	.99999	.99998	34
27	.99932	.99842	.99958	.99904	.99978	.99950	.99992	.99982	.99999	.99998	33
28	.99932	.99844	.99959	.99905	.99979	.99951	.99992	.99982	.99999	.99998	32
29	.99933	.99845	.99959	.99906	.99979	.99952	.99992	.99982	.99999	.99998	31
30	9.99933	0.99846	9.99959	0.99907	9.99979	0.99952	9.99993	0.99983	9.99999	0.99998	30
31	.99934	.99847	.99960	.99908	.99980	.99953	.99993	.99983	.99999	.99998	29
32	.99934	.99848	.99960	.99909	.99980	.99954	.99993	.99984	.99999	.99998	28
33	.99935	.99849	.99961	.99909	.99980	.99954	.99993	.99984	.99999	.99998	27
34	.99935	.99850	.99961	.99910	.99980	.99955	.99993	.99984	.99999	.99999	26
35	9.99935	0.99852	9.99961	0.99911	9.99981	0.99956	9.99993	0.99985	9.99999	0.99999	25
36	.99936	.99853	.99962	.99912	.99981	.99956	.99994	.99985	9.99999	.99999	24
37	.99936	.99854	.99962	.99913	.99981	.99957	.99994	.99985	0.00000	.99999	23
38	.99937	.99855	.99963	.99914	.99981	.99957	.99994	.99986	0.00000	.99999	22
39	.99937	.99856	.99963	.99915	.99982	.99958	.99994	.99986	0.00000	.99999	21
40	9.99938	0.99857	9.99963	0.99915	9.99982	0.99959	9.99994	0.99986	0.00000	0.99999	20
41	.99938	.99858	.99964	.99916	.99982	.99959	.99994	.99987	0.00000	.99999	19
42	.99939	.99859	.99964	.99917	.99983	.99960	.99994	.99987	0.00000	.99999	18
43	.99939	.99860	.99964	.99918	.99983	.99960	.99995	.99987	0.00000	.99999	17
44	.99940	.99861	.99965	.99919	.99983	.99961	.99995	.99988	0.00000	.99999	16
45	9.99940	0.99863	9.99965	0.99920	9.99983	0.99961	9.99995	0.99988	0.00000	1.00000	15
46	.99941	.99864	.99965	.99920	.99983	.99962	.99995	.99988	0.00000	0.00000	14
47	.99941	.99865	.99966	.99921	.99984	.99963	.99995	.99989	0.00000	0.00000	13
48	.99942	.99866	.99966	.99922	.99984	.99963	.99995	.99989	0.00000	0.00000	12
49	.99942	.99867	.99966	.99923	.99984	.99964	.99995	.99989	0.00000	0.00000	11
50	9.99943	0.99868	9.99967	0.99924	9.99984	0.99964	9.99996	0.99990	0.00000	1.00000	10
51	.99943	.99869	.99967	.99924	.99985	.99965	.99996	.99990	0.00000	0.00000	9
52	.99943	.99870	.99968	.99925	.99985	.99965	.99996	.99990	0.00000	0.00000	8
53	.99944	.99871	.99968	.99926	.99985	.99966	.99996	.99991	0.00000	0.00000	7
54	.99944	.99872	.99968	.99927	.99985	.99966	.99996	.99991	0.00000	0.00000	6
55	9.99945	0.99873	9.99969	0.99928	9.99986	0.99967	9.99996	0.99991	0.00000	1.00000	5
56	.99945	.99874	.99969	.99928	.99986	.99967	.99996	.99991	0.00000	0.00000	4
57	.99946	.99875	.99969	.99929	.99986	.99968	.99996	.99992	0.00000	0.00000	3
58	.99946	.99876	.99970	.99930	.99986	.99969	.99996	.99992	0.00000	0.00000	2
59	.99947	.99877	.99970	.99931	.99987	.99969	.99997	.99992	0.00000	0.00000	1
60	9.99947	0.99878	9.99970	0.99931	9.99987	0.99970	9.99997	0.99992	0.00000	1.00000	0
	184°		183°		182°		181°		180°		

Α (3)

	360°	359°	358°	357°	356°	355°	354°	353°	352°	351°	350°	349°	348°	347°	346°	345°
	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6
2	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2
3	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.3	3.6	3.9	4.2	4.5	4.8
4	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0	4.4	4.8	5.2	5.6	6.0	6.4
5	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0
6	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.8	8.4	9.0	9.6
7	0.7	1.4	2.1	2.8	3.5	4.2	4.9	5.6	6.3	7.0	7.7	8.4	9.1	9.8	10.5	11.2
8	0.8	1.6	2.4	3.2	4.0	4.8	5.6	6.4	7.2	8.0	8.8	9.6	10.4	11.2	12.0	12.8
9	0.9	1.8	2.7	3.6	4.5	5.4	6.3	7.2	8.1	9.0	9.9	10.8	11.7	12.6	13.5	14.4
10	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0
11	1.1	2.2	3.3	4.4	5.5	6.6	7.7	8.8	9.9	11.0	12.1	13.2	14.3	15.4	16.5	17.6
12	1.2	2.4	3.6	4.8	6.0	7.2	8.4	9.6	10.8	12.0	13.2	14.4	15.6	16.8	18.0	19.2
13	1.3	2.6	3.9	5.2	6.5	7.8	9.1	10.4	11.7	13.0	14.3	15.6	16.9	18.2	19.5	20.8
14	1.4	2.8	4.2	5.6	7.0	8.4	9.8	11.2	12.6	14.0	15.4	16.8	18.2	19.6	21.0	22.4
15	1.5	3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0	16.5	18.0	19.5	21.0	22.5	24.0
16	1.6	3.2	4.8	6.4	8.0	9.6	11.2	12.8	14.4	16.0	17.6	19.2	20.8	22.4	24.0	25.6
17	1.7	3.4	5.1	6.8	8.5	10.2	11.9	13.6	15.3	17.0	18.7	20.4	22.1	23.8	25.5	27.2
18	1.8	3.6	5.4	7.2	9.0	10.8	12.6	14.4	16.2	18.0	19.8	21.6	23.4	25.2	27.0	28.8
19	1.9	3.8	5.7	7.6	9.5	11.4	13.3	15.2	17.1	19.0	20.9	22.8	24.7	26.6	28.5	30.4
20	2.0	4.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0	22.0	24.0	26.0	28.0	30.0	32.0
21	2.1	4.2	6.3	8.4	10.5	12.6	14.7	16.8	18.9	21.0	23.1	25.2	27.3	29.4	31.5	33.6
22	2.2	4.4	6.6	8.8	11.0	13.2	15.4	17.6	19.8	22.0	24.2	26.4	28.6	30.8	33.0	35.2
23	2.3	4.6	6.9	9.2	11.5	13.8	16.1	18.4	20.7	23.0	25.3	27.6	29.9	32.2	34.5	36.8
24	2.4	4.8	7.2	9.6	12.0	14.4	16.8	19.2	21.6	24.0	26.4	28.8	31.2	33.6	36.0	38.4
25	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5	25.0	27.5	30.0	32.5	35.0	37.5	40.0
26	2.6	5.2	7.8	10.4	12.8	15.4	17.9	20.4	22.9	25.4	27.9	30.4	32.9	35.4	37.9	40.4
27	2.7	5.4	8.1	10.8	13.2	15.8	18.3	20.8	23.3	25.8	28.3	30.8	33.3	35.8	38.3	40.8
28	2.8	5.6	8.4	11.2	13.6	16.2	18.7	21.2	23.7	26.2	28.7	31.2	33.7	36.2	38.7	41.2
29	2.9	5.8	8.7	11.6	14.0	16.6	19.1	21.6	24.1	26.6	29.1	31.6	34.1	36.6	39.1	41.6
30	3.0	6.0	9.0	12.0	14.4	17.0	19.5	22.0	24.5	27.0	29.5	32.0	34.5	37.0	39.5	42.0
31	3.1	6.2	9.3	12.4	14.8	17.4	19.9	22.4	24.9	27.4	29.9	32.4	34.9	37.4	39.9	42.4
32	3.2	6.4	9.6	12.8	15.2	17.8	20.3	22.8	25.3	27.8	30.3	32.8	35.3	37.8	40.3	42.8
33	3.3	6.6	9.9	13.2	15.6	18.2	20.7	23.2	25.7	28.2	30.7	33.2	35.7	38.2	40.7	43.2
34	3.4	6.8	10.2	13.6	16.0	18.6	21.1	23.6	26.1	28.6	31.1	33.6	36.1	38.6	41.1	43.6
35	3.5	7.0	10.5	14.0	16.4	19.0	21.5	24.0	26.5	29.0	31.5	34.0	36.5	39.0	41.5	44.0
36	3.6	7.2	10.8	14.4	16.8	19.4	21.9	24.4	26.9	29.4	31.9	34.4	36.9	39.4	41.9	44.4
37	3.7	7.4	11.1	14.8	17.2	19.8	22.3	24.8	27.3	29.8	32.3	34.8	37.3	39.8	42.3	44.8
38	3.8	7.6	11.4	15.2	17.6	20.2	22.7	25.2	27.7	30.2	32.7	35.2	37.7	40.2	42.7	45.2
39	3.9	7.8	11.7	15.6	18.0	20.6	23.1	25.6	28.1	30.6	33.1	35.6	38.1	40.6	43.1	45.6
40	4.0	8.0	12.0	16.0	18.4	21.0	23.5	26.0	28.5	31.0	33.5	36.0	38.5	41.0	43.5	46.0
41	4.1	8.2	12.3	16.4	18.8	21.4	23.9	26.4	28.9	31.4	33.9	36.4	38.9	41.4	43.9	46.4
42	4.2	8.4	12.6	16.8	19.2	21.8	24.3	26.8	29.3	31.8	34.3	36.8	39.3	41.8	44.3	46.8
43	4.3	8.6	12.9	17.2	19.6	22.2	24.7	27.2	29.7	32.2	34.7	37.2	39.7	42.2	44.7	47.2
44	4.4	8.8	13.2	17.6	20.0	22.6	25.1	27.6	30.1	32.6	35.1	37.6	40.1	42.6	45.1	47.6
45	4.5	9.0	13.5	18.0	20.4	23.0	25.5	28.0	30.5	33.0	35.5	38.0	40.5	43.0	45.5	48.0
46	4.6	9.2	13.8	18.4	20.8	23.4	25.9	28.4	30.9	33.4	35.9	38.4	40.9	43.4	45.9	48.4
47	4.7	9.4	14.1	18.8	21.2	23.8	26.3	28.8	31.3	33.8	36.3	38.8	41.3	43.8	46.3	48.8
48	4.8	9.6	14.4	19.2	21.6	24.2	26.7	29.2	31.7	34.2	36.7	39.2	41.7	44.2	46.7	49.2
49	4.9	9.8	14.7	19.6	22.0	24.6	27.1	29.6	32.1	34.6	37.1	39.6	42.1	44.6	47.1	49.6
50	5.0	10.0	15.0	20.0	22.4	25.0	27.5	30.0	32.5	35.0	37.5	40.0	42.5	45.0	47.5	50.0
51	5.1	10.2	15.3	20.4	22.8	25.4	27.9	30.4	32.9	35.4	37.9	40.4	42.9	45.4	47.9	50.4
52	5.2	10.4	15.6	20.8	23.2	25.8	28.3	30.8	33.3	35.8	38.3	40.8	43.3	45.8	48.3	50.8
53	5.3	10.6	15.9	21.2	23.6	26.2	28.7	31.2	33.7	36.2	38.7	41.2	43.7	46.2	48.7	51.2
54	5.4	10.8	16.2	21.6	24.0	26.6	29.1	31.6	34.1	36.6	39.1	41.6	44.1	46.6	49.1	51.6
55	5.5	11.0	16.5	22.0	24.4	27.0	29.5	32.0	34.5	37.0	39.5	42.0	44.5	47.0	49.5	52.0
56	5.6	11.2	16.8	22.4	24.8	27.4	29.9	32.4	34.9	37.4	39.9	42.4	44.9	47.4	49.9	52.4
57	5.7	11.4	17.1	22.8	25.2	27.8	30.3	32.8	35.3	37.8	40.3	42.8	45.3	47.8	50.3	52.8
58	5.8	11.6	17.4	23.2	25.6	28.2	30.7	33.2	35.7	38.2	40.7	43.2	45.7	48.2	50.7	53.2
59	5.9	11.8	17.7	23.6	26.0	28.6	31.1	33.6	36.1	38.6	41.1	43.6	46.1	48.6	51.1	53.6
60	6.0	12.0	18.0	24.0	26.4	29.0	31.5	34.0	36.5	39.0	41.5	44.0	46.5	49.0	51.5	54.0
61	6.1	12.2	18.3	24.4	26.8	29.4	31.9	34.4	36.9	39.4	41.9	44.4	46.9	49.4	51.9	54.4
62	6.2	12.4	18.6	24.8	27.2	29.8	32.3	34.8	37.3	39.8	42.3	44.8	47.3	49.8	52.3	54.8
63	6.3	12.6	18.9	25.2	27.6	30.2	32.7	35.2	37.7	40.2	42.7	45.2	47.7	50.2	52.7	55.2
64	6.4	12.8	19.2	25.6	28.0	30.6	33.1	35.6	38.1	40.6	43.1	45.6	48.1	50.6	53.1	55.6
65	6.5	13.0	19.5	26.0	28.4	31.0	33.5	36.0	38.5	41.0	43.5	46.0	48.5	51.0	53.5	56.0
66	6.6	13.2	19.8	26.4	28.8	31.4	33.9	36.4	38.9	41.4	43.9	46.4	48.9	51.4	53.9	56.4
67	6.7	13.4	20.1	26.8	29.2	31.8	34.3	36.8	39.3	41.8	44.3	46.8	49.3	51.8	54.3	56.8
68	6.8	13.6	20.4	27.2	29.6	32.2	34.7	37.2	39.7	42.2	44.7	47.2	49.7	52.2	54.7	57.2
69	6.9	13.8	20.7	27.6	30.0	32.6	35.1	37.6	40.1	42.6	45.1	47.6	50.1	52.6	55.1	57.6
70	7.0	14.0	21.0	28.0	30.4	33.0	35.5	38.0	40.5	43.0	45.5	48.0	50.5	53.0	55.5	58.0
71	7.1	14.2	21.3	28.4	30.8	33.4	35.9	38.4	40.9	43.4	45.9	48.4	50.9	53.4	55.9	58.4
72	7.2	14.4	21.6	28.8	31.2	33.8	36.3	38.8	41.3	43.8	46.3	48.8	51.3	53.8	56.3	58.8
73	7.3	14.6	21.9	29.2	31.6	34.2	36.7	39.2	41.7	44.2	46.7	49.2	51.7	54.2	56.7	59.2
74	7.4	14.8	22.2	29.6	32.0	34.6	37.1	39.6	42.1	44.6	47.1	49.6	52.1	54.6	57.1	59.6
75	7.5	15.0	22.5	30.0	32.4	35.0	37.5	40.0	42.5	45.0	47.5	50.0	52.5	55.0	57.5	60.0
76	7.6	15.2	22.8	30.4	32.8	35.4	37.9	40.4	42.9	45.4	47.9	50.4	52.9	55.4	57.9	60.4
77	7.7	15.4	23.1	30.8	33.2	35.8	38.3	40.8	43.3	45.8	48.3	50.8	53.3	55.8	58.3	60.8
78	7.8	15.6	23.4	31.2	33.6	36.2	38.7	41.2	43.7	46.2	48.7	51.2	53.7	56.2	58.7	61.2
79	7.9	15.8	23.7	31.6	34.0	36.6	39.1	41								

③	360°	359°	358°	357°	356°	355°	354°	353°	352°	351°	350°	349°	348°	347°	346°	345°
	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°
0°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	10.0	5.0	3.3	2.5	2.0	1.7	1.4	1.3	1.1	1.0	0.9	0.8	0.8	0.7	0.7	0.7
2	20.0	10.0	6.7	5.0	4.0	3.3	2.9	2.5	2.2	2.0	1.8	1.7	1.6	1.4	1.3	1.3
3	30.0	15.0	10.0	7.5	6.0	5.0	4.3	3.8	3.4	3.0	2.7	2.5	2.3	2.2	2.0	2.0
4	40.1	20.0	13.4	10.0	8.0	6.7	5.7	5.0	4.5	4.0	3.7	3.4	3.1	2.9	2.7	2.7
5	50.1	25.1	16.7	12.5	10.0	8.4	7.2	6.3	5.6	5.0	4.6	4.2	3.9	3.6	3.4	3.4
6	60.2	30.1	20.1	15.1	12.1	10.1	8.6	7.6	6.7	6.1	5.5	5.1	4.7	4.3	4.1	4.1
7	70.4	35.2	23.5	17.6	14.1	11.7	10.1	8.8	7.8	7.1	6.4	5.9	5.5	5.1	4.7	4.7
8	80.5	40.3	26.9	20.1	16.1	13.4	11.5	10.1	9.0	8.1	7.4	6.8	6.2	5.8	5.4	5.4
9	90.8	45.4	30.3	22.7	18.2	15.2	13.0	11.4	10.1	9.1	8.3	7.6	7.0	6.5	6.1	6.1
10	101	50.5	33.7	25.3	20.2	16.9	14.5	12.7	11.3	10.2	9.2	8.5	7.8	7.3	6.8	6.8
11	111	55.7	37.1	27.9	22.3	18.6	15.9	14.0	12.4	11.2	10.2	9.3	8.6	8.0	7.5	7.5
12	121	60.9	40.6	30.5	24.4	20.3	17.4	15.3	13.6	12.2	11.1	10.2	9.4	8.8	8.2	8.2
13	132	66.2	44.1	33.1	26.5	22.1	18.9	16.6	14.8	13.3	12.1	11.1	10.3	9.5	8.9	8.9
14	142	71.4	47.6	35.7	28.6	23.9	20.5	17.9	15.9	14.4	13.1	12.0	11.1	10.3	9.6	9.6
15	153	76.8	51.2	38.4	30.7	25.6	22.0	19.3	17.1	15.4	14.0	12.9	11.9	11.1	10.4	10.4
16	164	82.2	54.8	41.1	32.9	27.4	23.5	20.6	18.3	16.5	15.0	13.8	12.7	11.9	11.1	11.1
17	175	87.6	58.4	43.8	35.1	29.2	25.1	22.0	19.5	17.6	16.0	14.7	13.6	12.6	11.8	11.8
18	186	93.1	62.1	46.6	37.3	31.1	26.7	23.3	20.8	18.7	17.0	15.6	14.4	13.4	12.6	12.6
19	197	98.7	65.8	49.4	39.5	32.9	28.3	24.7	22.0	19.8	18.0	16.6	15.3	14.2	13.3	13.3
20	208	104	69.5	52.2	41.8	34.8	29.9	26.2	23.3	21.0	19.1	17.5	16.2	15.0	14.1	14.1
21	219	110	73.3	55.0	44.0	36.7	31.5	27.6	24.5	22.1	20.1	18.5	17.1	15.9	14.8	14.8
22	231	115	77.2	57.9	46.4	38.7	33.2	29.0	25.8	23.3	21.2	19.4	18.0	16.7	15.6	15.6
23	243	121	81.1	60.9	48.7	40.6	34.8	30.5	27.1	24.4	22.2	20.4	18.9	17.5	16.4	16.4
24	255	127	85.1	63.8	51.1	42.6	36.5	32.0	28.5	25.6	23.3	21.4	19.8	18.4	17.2	17.2
25	267	133	89.1	66.8	53.5	44.6	38.3	33.5	29.8	26.9	24.4	22.4	20.7	19.3	18.0	18.0
26	279	139	93.2	69.9	56.0	46.7	40.0	35.0	31.2	28.1	25.6	23.5	21.7	20.2	18.8	18.8
27	292	146	97.4	73.0	58.5	48.7	41.8	36.6	32.6	29.3	26.7	24.5	22.7	21.1	19.7	19.7
28	304	152	101	76.2	61.0	50.9	43.6	38.2	34.0	30.6	27.9	25.6	23.6	22.0	20.5	20.5
29	317	158	105	79.5	63.6	53.0	45.5	39.8	35.4	31.9	29.1	26.7	24.6	22.9	21.4	21.4
30	330	165	110	82.8	66.2	55.2	47.4	41.5	36.9	33.2	30.3	27.8	25.7	23.9	22.3	22.3
31	344	172	114	86.1	68.9	57.5	49.3	43.2	38.4	34.6	31.5	28.9	26.7	24.8	23.2	23.2
32	358	179	119	89.6	71.7	59.8	51.3	44.9	39.9	36.0	32.7	29.9	27.6	25.8	24.1	24.1
33	372	186	124	93.1	74.5	62.1	53.3	46.7	41.5	37.4	34.0	31.2	28.9	26.8	25.1	25.1
34	386	193	128	96.7	77.4	64.5	55.3	48.5	43.1	38.8	35.3	32.4	30.0	27.9	26.1	26.1
35	401	200	133	100	80.3	67.0	57.5	50.3	44.8	40.3	36.7	33.7	31.1	28.9	27.1	27.1
36	416	208	138	104	83.4	69.5	59.6	52.2	46.4	41.8	38.1	34.9	32.3	30.0	28.1	28.1
37	431	215	144	108	86.5	72.1	61.8	54.1	48.2	43.4	39.5	36.2	33.5	31.1	29.1	29.1
38	447	223	149	112	89.6	74.7	64.1	56.1	49.9	45.0	40.9	37.6	34.7	32.3	30.2	30.2
39	464	232	154	116	92.9	77.5	66.4	58.2	51.8	46.6	42.4	38.9	36.0	33.5	31.3	31.3
40	480	240	160	120	96.3	80.3	68.9	60.3	53.6	48.3	44.0	40.4	37.3	34.7	32.4	32.4
41	498	249	166	124	99.7	83.2	71.3	62.5	55.6	50.1	45.6	41.8	38.6	35.9	33.6	33.6
42	515	258	172	129	103	86.1	73.9	64.7	57.6	51.9	47.2	43.3	40.0	37.2	34.8	34.8
43	534	267	178	133	107	89.2	76.5	67.0	59.6	53.7	48.9	44.9	41.5	38.5	36.0	36.0
44	553	276	184	138	110	92.4	79.2	69.4	61.7	55.6	50.6	46.4	42.9	39.9	37.3	37.3
45	573	286	191	143	114	95.7	82.1	71.9	63.9	57.6	52.4	48.1	44.5	41.3	38.6	38.6
46	593	296	197	148	118	99.1	85.0	74.4	66.2	59.6	54.3	49.8	46.0	42.8	40.0	40.0
47	614	307	204	153	123	102	88.0	77.1	68.6	61.8	56.2	51.6	47.7	44.3	41.4	41.4
48	636	318	212	159	127	106	91.1	79.8	71.0	64.0	58.2	53.4	49.4	45.9	42.9	42.9
49	659	329	219	164	132	110	94.4	82.7	73.5	66.2	60.3	55.3	51.1	47.6	44.4	44.4
50	682	341	227	170	136	114	97.8	85.6	76.2	68.6	62.5	57.3	53.0	49.3	46.0	46.0
51	707	353	236	177	141	118	101	88.7	78.9	71.1	64.7	59.4	54.9	51.0	47.7	47.7
52	733	366	244	183	146	122	105	92.0	81.8	73.7	67.1	61.6	56.9	52.9	49.5	49.5
53	760	380	253	190	152	127	108	95.4	84.8	76.4	69.5	63.8	59.0	54.9	51.3	51.3
54	788	394	263	197	157	131	112	98.9	88.0	79.3	72.1	66.2	61.2	56.9	53.2	53.2
55	818	409	272	204	163	136	117	102	91.3	82.2	74.8	68.7	63.5	59.0	55.2	55.2
56	849	424	283	212	170	141	121	106	94.8	85.4	77.7	71.3	65.9	61.3	57.3	57.3
57	882	441	294	220	176	147	126	110	98.4	88.7	80.7	74.1	68.5	63.7	59.5	59.5
58	917	458	305	229	183	153	131	115	102	92.2	83.9	77.0	71.1	66.2	61.8	61.8
59	953	476	318	238	191	159	136	119	106	95.8	87.2	80.0	74.0	68.8	64.3	64.3
60	992	496	330	248	198	165	142	124	110	99.7	90.8	83.3	77.0	71.6	66.9	66.9
61	1033	516	344	258	207	172	148	129	115	103	94.6	86.8	80.2	74.6	69.7	69.7
62	1077	538	359	269	215	179	154	135	120	108	98.6	90.5	83.6	77.7	72.7	72.7
63	1124	562	375	281	225	187	161	141	125	113	102	94.4	87.2	81.1	75.8	75.8
64	1174	587	391	293	235	196	168	147	131	118	107	98.6	91.1	84.8	79.2	79.2
65	1228	614	409	307	246	205	176	154	137	123	112	103	95.3	88.6	82.9	82.9
66	1290	644	429	322	258	215	184	161	144	129	118	108	99.8	92.8	86.8	86.8
67	1350	675	450	338	270	225	193	169	151	136	123	113	105	97.4	91.0	91.0
68	1420	709	473	355	284	237	203	178	158	143	130	119	110	102	95.6	95.6
69	1490	746	498	373	299	249	214	187	167	150	137	125	116	108	101	101
70	1570	787	525	394	315	263	225	197	176	158	144	132	122	114	106	106
71	1660	832	555	416	333	278	238	209	186	167	152	140	129	120	112	112
72	1760	882	588	441	353	294	253	221	197	177	161	148	137	127	119	119
73	1870	937	625	469	375	313	268	235	209	188	171	157	145	135	126	126
74	2000	1000	666	500	400	334	286	251	223	201	183	168	155	144	135	135
75	2140	1070	713	535	428	357	306	268	239	215	196	180	166	154	144	144
	180°	179°	178°	177°	176°	175°	174°	173°	172°	171°	170°	169°	168°	167°	166°	165°
	180°	181°	182°	183°	184°	185°	186°	187°	188°	189°	190°	191°	192°	193°	194°	195°

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	345°	344°	343°	342°	341°	340°	339°	338°	337°	336°	335°	334°	333°	332°	331°	330°
	15°	16°	17°	18°	19°	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°	30°
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0.7	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3
2	1.3	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.7	0.6	0.6
3	2.0	1.8	1.7	1.6	1.5	1.4	1.4	1.3	1.2	1.2	1.1	1.1	1.0	1.0	0.9	0.9
4	2.6	2.4	2.3	2.2	2.0	1.9	1.8	1.7	1.6	1.6	1.5	1.4	1.4	1.3	1.3	1.2
5	3.3	3.1	2.9	2.7	2.5	2.4	2.3	2.2	2.1	2.0	1.9	1.8	1.7	1.6	1.6	1.5
6	3.9	3.7	3.4	3.2	3.1	2.9	2.7	2.6	2.5	2.4	2.3	2.2	2.1	2.0	1.9	1.8
7	4.6	4.3	4.0	3.8	3.6	3.4	3.2	3.0	2.9	2.8	2.6	2.5	2.4	2.3	2.2	2.1
8	5.2	4.9	4.6	4.3	4.1	3.9	3.7	3.5	3.3	3.2	3.0	2.9	2.8	2.6	2.5	2.4
9	5.9	5.3	5.2	4.9	4.6	4.4	4.1	3.9	3.7	3.6	3.4	3.2	3.1	3.0	2.9	2.7
10	6.6	6.1	5.8	5.4	5.1	4.8	4.6	4.4	4.2	4.0	3.8	3.6	3.5	3.3	3.2	3.1
11	7.2	6.8	6.4	6.0	5.6	5.3	5.1	4.8	4.6	4.4	4.2	4.0	3.8	3.7	3.5	3.4
12	7.9	7.4	7.0	6.5	6.2	5.8	5.5	5.3	5.0	4.8	4.6	4.4	4.2	4.0	3.8	3.7
13	8.6	8.1	7.6	7.1	6.7	6.3	6.0	5.7	5.4	5.2	5.0	4.7	4.5	4.3	4.2	4.0
14	9.3	8.7	8.2	7.7	7.2	6.9	6.5	6.2	5.9	5.6	5.3	5.1	4.9	4.7	4.5	4.3
15	10.0	9.3	8.8	8.2	7.8	7.4	7.0	6.6	6.3	6.0	5.7	5.5	5.3	5.0	4.8	4.6
16	10.7	10.0	9.4	8.8	8.3	7.9	7.5	7.1	6.8	6.4	6.1	5.9	5.6	5.4	5.2	5.0
17	11.4	10.7	10.0	9.4	8.9	8.4	8.0	7.6	7.2	6.9	6.6	6.3	6.0	5.7	5.5	5.3
18	12.1	11.3	10.6	10.0	9.4	8.9	8.5	8.0	7.7	7.3	7.0	6.7	6.4	6.1	5.9	5.6
19	12.9	12.0	11.3	10.6	10.0	9.5	9.0	8.5	8.1	7.7	7.4	7.1	6.8	6.5	6.2	6.0
20	13.6	12.7	11.9	11.2	10.6	10.0	9.5	9.0	8.6	8.2	7.8	7.5	7.1	6.8	6.6	6.3
21	14.3	13.4	12.6	11.8	11.1	10.5	10.0	9.5	9.0	8.6	8.2	7.9	7.5	7.2	6.9	6.6
22	15.1	14.1	13.2	12.4	11.7	11.1	10.5	10.0	9.5	9.1	8.7	8.3	7.9	7.6	7.3	7.0
23	15.8	14.8	13.9	13.1	12.3	11.7	11.1	10.5	10.0	9.5	9.1	8.7	8.3	8.0	7.7	7.4
24	16.6	15.5	14.6	13.7	12.9	12.2	11.6	11.0	10.5	10.0	9.5	9.1	8.7	8.4	8.0	7.7
25	17.4	16.3	15.3	14.4	13.5	12.8	12.1	11.5	11.0	10.5	10.0	9.6	9.2	8.8	8.4	8.1
26	18.2	17.0	16.0	15.0	14.2	13.4	12.7	12.1	11.5	11.0	10.5	10.0	9.6	9.2	8.8	8.4
27	19.0	17.8	16.7	15.7	14.8	14.0	13.3	12.6	12.0	11.4	10.9	10.4	10.0	9.6	9.2	8.8
28	19.8	18.5	17.4	16.4	15.4	14.6	13.9	13.2	12.5	11.9	11.4	10.9	10.4	10.0	9.6	9.2
29	20.7	19.3	18.1	17.1	16.1	15.2	14.4	13.7	13.1	12.5	11.9	11.4	10.9	10.4	10.0	9.6
30	21.5	20.1	18.9	17.8	16.8	15.9	15.0	14.3	13.6	13.0	12.4	11.8	11.3	10.9	10.4	10.0
31	22.4	21.0	19.7	18.5	17.5	16.5	15.7	14.9	14.2	13.5	12.9	12.3	11.8	11.3	10.8	10.4
32	23.3	21.8	20.4	19.2	18.1	17.2	16.3	15.5	14.7	14.0	13.4	12.8	12.3	11.8	11.3	10.8
33	24.2	22.6	21.2	20.0	18.9	17.8	16.9	16.1	15.3	14.6	13.9	13.3	12.7	12.2	11.7	11.2
34	25.2	23.5	22.1	20.8	19.6	18.5	17.6	16.7	15.9	15.1	14.5	13.8	13.2	12.7	12.2	11.7
35	26.1	24.4	22.9	21.6	20.3	19.2	18.2	17.3	16.5	15.7	15.0	14.4	13.7	13.2	12.6	12.1
36	27.1	25.3	23.8	22.4	21.1	20.0	18.9	18.0	17.1	16.3	15.6	14.9	14.3	13.7	13.1	12.6
37	28.1	26.3	24.6	23.2	21.9	20.7	19.6	18.7	17.8	16.9	16.2	15.5	14.8	14.2	13.6	13.1
38	29.2	27.2	25.6	24.0	22.7	21.5	20.4	19.3	18.4	17.5	16.8	16.0	15.3	14.7	14.1	13.5
39	30.2	28.2	26.5	24.9	23.5	22.2	21.1	20.0	19.1	18.2	17.4	16.6	15.9	15.2	14.6	14.0
40	31.3	29.3	27.4	25.8	24.4	23.1	21.9	20.8	19.8	18.8	18.0	17.2	16.5	15.8	15.1	14.5
41	32.4	30.3	28.4	26.8	25.2	23.9	22.6	21.5	20.5	19.5	18.6	17.8	17.1	16.3	15.7	15.1
42	33.6	31.4	29.5	27.7	26.1	24.7	23.5	22.3	21.2	20.2	19.3	18.5	17.7	16.9	16.2	15.6
43	34.8	32.5	30.5	28.7	27.1	25.6	24.3	23.1	22.0	20.9	20.0	19.1	18.3	17.5	16.8	16.2
44	36.0	33.7	31.6	29.7	28.0	26.5	25.2	23.9	22.8	21.7	20.7	19.8	19.0	18.2	17.4	16.7
45	37.3	34.9	32.7	30.8	29.0	27.5	26.1	24.8	23.6	22.5	21.4	20.5	19.6	18.8	18.0	17.3
46	38.6	36.1	33.9	31.9	30.1	28.5	27.0	25.6	24.4	23.3	22.2	21.2	20.3	19.5	18.7	17.9
47	40.0	37.4	35.1	33.0	31.1	29.5	27.9	26.5	25.3	24.1	23.0	22.0	21.0	20.2	19.3	18.6
48	41.4	38.7	36.3	34.2	32.3	30.5	28.9	27.5	26.2	24.9	23.8	22.8	21.8	20.9	20.0	19.2
49	42.9	40.1	37.6	35.4	33.4	31.6	30.0	28.5	27.1	25.8	24.7	23.6	22.6	21.6	20.8	19.9
50	44.5	41.6	39.0	36.7	34.6	32.7	31.0	29.5	28.1	26.8	25.6	24.4	23.4	22.4	21.5	20.6
51	46.1	43.1	40.4	38.0	35.9	33.9	32.2	30.6	29.1	27.7	26.5	25.3	24.2	23.2	22.3	21.4
52	47.8	44.6	41.9	39.4	37.2	35.2	33.3	31.7	30.2	28.7	27.4	26.2	25.1	24.1	23.1	22.2
53	49.5	46.3	43.4	40.8	38.5	36.5	34.6	32.8	31.3	29.8	28.5	27.2	26.0	25.0	23.9	23.0
54	51.4	48.0	45.0	42.4	40.0	37.8	35.9	34.1	32.4	30.9	29.5	28.2	27.0	25.9	24.8	23.8
55	53.3	49.8	46.7	44.0	41.5	39.2	37.2	35.3	33.6	32.1	30.6	29.3	28.0	26.9	25.8	24.7
56	55.3	51.7	48.5	45.6	43.1	40.7	38.6	36.7	34.9	33.3	31.8	30.4	29.1	27.9	26.7	25.7
57	57.5	53.7	50.4	47.4	44.7	42.3	40.1	38.1	36.3	34.6	33.0	31.6	30.2	29.0	27.8	26.7
58	59.7	55.8	52.3	49.3	46.5	44.0	41.7	39.6	37.7	35.9	34.3	32.8	31.4	30.1	28.9	27.7
59	62.1	58.0	54.4	51.2	48.3	45.7	43.4	41.2	39.2	37.4	35.7	34.1	32.7	31.3	30.0	28.8
60	64.6	60.4	56.7	53.3	50.3	47.6	45.1	42.9	40.8	38.9	37.1	35.5	34.0	32.6	31.2	30.0
61	67.3	62.9	59.0	55.5	52.4	49.6	47.0	44.7	42.5	40.5	38.7	37.0	35.4	33.9	32.6	31.3
62	70.2	65.6	61.5	57.9	54.6	51.7	49.0	46.6	44.3	42.2	40.3	38.6	36.9	35.4	33.9	32.6
63	73.3	68.4	64.2	60.4	57.0	53.9	51.1	48.6	46.2	44.1	42.1	40.2	38.5	36.9	35.4	34.0
64	76.5	71.5	67.1	63.1	59.6	56.3	53.4	50.8	48.3	46.1	44.0	42.0	40.2	38.6	37.0	35.5
65	80.0	74.8	70.1	66.0	62.3	58.9	55.9	53.1	50.5	48.2	46.0	44.0	42.1	40.3	38.7	37.1
66	83.8	78.3	73.5	69.1	65.2	61.7	58.5	55.6	52.9	50.4	48.2	46.1	44.1	42.2	40.5	38.9
67	87.9	82.2	77.1	72.5	68.4	64.7	61.4	58.3	55.5	52.9	50.5	48.3	46.2	44.3	42.5	40.8
68	92.4	86.3	81.0	76.2	71.9	68.0	64.5	61.3	58.3	55.6	53.1	50.7	48.6	46.5	44.7	42.9
69	97.2	90.9	85.2	80.2	75.7	71.6	67.9	64.5	61.4	58.5	55.9	53.4	51.1	49.0	47.0	45.1
70	103	95.8	89.9	84.6	79.8	75.5	71.6	68.0	64.7	61.7	58.9	56.3	53.9	51.7	49.6	47.8
71	108	101	95.0	89.4	84.3	79.8	75.7	71.9	68.4	65.2	62.3	59.6	57.0	54.6	52.4	50.3
72	115	107	101	94.7	89.4	84.6	80.2	76.2	72.5	69.1	66.0	63.1	60.4	57.9	55.5	53.3
73	122	114	107	101	95.0	89.9	85.2	81.0	77.1	73.5	70.1	67.1	64.2	61.5	59.0	56.7
74	130	122	114	107	101	95.8	90.9	86.3	82.2	78.3	74.8	71.5	68.4	65.6	62.9	60.4
75	139	130	122	115	108	103	97.2	92.4	87.9	83.8	80.0	76.5	73.2	70.2	67.3	64.6
	165°	164°	163°	162°	161°	160°	159°	158°	157°	156°	155°	154°	153°	152°	151°	150°
R4	195°	196°	197°	198°	199°	200°	201°	202°	203°	204°	205°	206°	207°	208°	209°	210°

3	345°	344°	343°	342°	341°	340°	339°	338°	337°	336°	335°	334°	333°	332°	331°	330°
	15°	16°	17°	18°	19°	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°	30°
0°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3
2	1.3	1.3	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.8	0.7	0.7	0.7
3	2.0	1.9	1.8	1.7	1.6	1.5	1.5	1.4	1.3	1.3	1.2	1.2	1.2	1.1	1.1	1.0
4	2.7	2.5	2.4	2.3	2.1	2.0	2.0	1.9	1.8	1.7	1.7	1.6	1.5	1.5	1.4	1.4
5	3.4	3.2	3.0	2.8	2.7	2.6	2.4	2.3	2.2	2.2	2.1	2.0	1.9	1.9	1.8	1.7
6	4.1	3.8	3.6	3.4	3.2	3.1	2.9	2.8	2.7	2.6	2.5	2.4	2.3	2.2	2.2	2.1
7	4.7	4.5	4.2	4.0	3.8	3.6	3.4	3.3	3.1	3.0	2.9	2.8	2.7	2.6	2.5	2.5
8	5.4	5.1	4.8	4.5	4.3	4.1	3.9	3.8	3.6	3.3	3.3	3.2	3.1	3.0	2.9	2.8
9	6.1	5.7	5.4	5.1	4.9	4.6	4.4	4.2	4.1	3.9	3.7	3.6	3.5	3.4	3.3	3.2
10	6.8	6.4	6.0	5.7	5.4	5.2	4.9	4.7	4.5	4.3	4.2	4.0	3.9	3.8	3.6	3.5
11	7.5	7.1	6.6	6.3	6.0	5.7	5.4	5.2	5.0	4.8	4.6	4.4	4.3	4.1	4.0	3.9
12	8.2	7.7	7.3	6.9	6.5	6.2	5.9	5.7	5.4	5.2	5.0	4.8	4.7	4.5	4.4	4.3
13	8.9	8.4	7.9	7.5	7.1	6.8	6.4	6.2	5.9	5.7	5.5	5.3	5.1	4.9	4.8	4.6
14	9.6	9.0	8.5	8.1	7.7	7.3	7.0	6.7	6.4	6.1	5.9	5.7	5.5	5.3	5.1	5.0
15	10.4	9.7	9.2	8.7	8.2	7.8	7.5	7.2	6.9	6.6	6.3	6.1	5.9	5.7	5.5	5.4
16	11.1	10.4	9.8	9.3	8.8	8.4	8.0	7.7	7.3	7.0	6.8	6.5	6.3	6.1	5.9	5.7
17	11.8	11.1	10.5	9.9	9.4	8.9	8.5	8.2	7.8	7.5	7.2	7.0	6.7	6.5	6.3	6.1
18	12.6	11.8	11.1	10.5	10.0	9.5	9.1	8.7	8.3	8.0	7.7	7.4	7.2	6.9	6.7	6.5
19	13.3	12.5	11.8	11.1	10.6	10.1	9.6	9.2	8.8	8.5	8.1	7.9	7.6	7.3	7.1	6.9
20	14.1	13.2	12.4	11.8	11.2	10.6	10.2	9.7	9.3	8.9	8.6	8.3	8.0	7.8	7.5	7.3
21	14.8	13.9	13.1	12.4	11.8	11.2	10.7	10.2	9.8	9.4	9.1	8.8	8.5	8.2	7.9	7.7
22	15.6	14.7	13.8	13.1	12.4	11.8	11.3	10.8	10.3	9.9	9.6	9.2	8.9	8.6	8.3	8.1
23	16.4	15.4	14.5	13.7	13.0	12.4	11.8	11.3	10.9	10.4	10.0	9.7	9.3	9.0	8.8	8.5
24	17.2	16.2	15.2	14.4	13.7	13.0	12.4	11.9	11.4	10.9	10.5	10.2	9.8	9.5	9.2	8.9
25	18.0	16.9	15.9	15.1	14.3	13.6	13.0	12.4	11.9	11.5	11.0	10.6	10.3	9.9	9.6	9.3
26	18.8	17.7	16.7	15.8	15.0	14.3	13.6	13.0	12.5	12.0	11.5	11.1	10.7	10.4	10.1	9.8
27	19.7	18.5	17.4	16.5	15.7	14.9	14.2	13.6	13.0	12.5	12.1	11.6	11.2	10.9	10.5	10.2
28	20.5	19.3	18.2	17.2	16.3	15.5	14.8	14.2	13.6	13.1	12.6	12.1	11.7	11.3	11.0	10.6
29	21.4	20.1	19.0	17.9	17.0	16.2	15.5	14.8	14.2	13.6	13.1	12.6	12.2	11.8	11.4	11.1
30	22.3	20.9	19.7	18.7	17.7	16.9	16.1	15.4	14.8	14.2	13.7	13.2	12.7	12.3	11.9	11.5
31	23.2	21.8	20.6	19.4	18.5	17.6	16.8	16.0	15.4	14.8	14.2	13.7	13.2	12.8	12.4	12.0
32	24.1	22.7	21.4	20.2	19.2	18.3	17.4	16.7	16.0	15.4	14.8	14.3	13.8	13.3	12.9	12.5
33	25.1	23.6	22.2	21.0	19.9	19.0	18.1	17.3	16.6	16.0	15.4	14.8	14.3	13.8	13.4	13.0
34	26.1	24.5	23.1	21.8	20.7	19.7	18.8	18.0	17.3	16.6	16.0	15.4	14.9	14.4	13.9	13.5
35	27.1	25.4	23.9	22.7	21.5	20.5	19.5	18.7	17.9	17.2	16.6	16.0	15.4	14.9	14.4	14.0
36	28.1	26.4	24.8	23.5	22.3	21.2	20.3	19.4	18.6	17.9	17.2	16.6	16.0	15.5	15.0	14.5
37	29.1	27.3	25.8	24.4	23.1	22.0	21.0	20.1	19.3	18.5	17.8	17.2	16.6	16.1	15.5	15.1
38	30.2	28.3	26.7	25.3	24.0	22.8	21.8	20.9	20.0	19.2	18.5	17.8	17.2	16.6	16.1	15.6
39	31.3	29.4	27.7	26.2	24.9	23.7	22.6	21.6	20.7	19.9	19.2	18.5	17.8	17.2	16.7	16.2
40	32.4	30.4	28.7	27.2	25.8	24.5	23.4	22.4	21.5	20.6	19.9	19.1	18.5	17.9	17.3	16.8
41	33.6	31.5	29.7	28.1	26.7	25.4	24.3	23.2	22.2	21.4	20.6	19.8	19.1	18.5	17.9	17.4
42	34.8	32.7	30.8	29.1	27.7	26.3	25.1	24.0	23.0	22.1	21.3	20.5	19.8	19.2	18.6	18.0
43	36.0	33.8	31.9	30.2	28.6	27.3	26.0	24.9	23.9	22.9	22.1	21.3	20.5	19.9	19.2	18.7
44	37.3	35.0	33.0	31.3	29.7	28.2	26.9	25.8	24.7	23.7	22.9	22.0	21.3	20.6	19.9	19.3
45	38.6	36.3	34.2	32.4	30.7	29.2	27.9	26.7	25.6	24.6	23.7	22.8	22.0	21.3	20.6	20.0
46	40.0	37.6	35.4	33.5	31.8	30.3	28.9	27.6	26.5	25.5	24.5	23.6	22.8	22.1	21.4	20.7
47	41.4	38.9	36.7	34.7	32.9	31.4	29.9	28.6	27.4	26.4	25.4	24.5	23.6	22.8	22.1	21.4
48	42.9	40.3	38.0	35.9	34.1	32.5	31.0	29.6	28.4	27.3	26.3	25.3	24.5	23.7	22.9	22.2
49	44.4	41.7	39.3	37.2	35.3	33.6	32.1	30.7	29.4	28.3	27.2	26.2	25.3	24.5	23.7	23.0
50	46.0	43.2	40.8	38.6	36.6	34.8	33.3	31.8	30.5	29.3	28.2	27.2	26.3	25.4	24.6	23.8
51	47.7	44.8	42.2	40.0	37.9	36.1	34.5	33.0	31.6	30.4	29.2	28.2	27.2	26.3	25.5	24.7
52	49.5	46.4	43.8	41.4	39.3	37.4	35.7	34.2	32.8	31.5	30.3	29.2	28.2	27.3	26.4	25.6
53	51.3	48.1	45.4	42.9	40.8	38.8	37.0	35.4	34.0	32.6	31.4	30.3	29.2	28.3	27.4	26.5
54	53.2	49.9	47.1	44.5	42.3	40.2	38.4	36.7	35.2	33.8	32.6	31.4	30.3	29.3	28.4	27.5
55	55.2	51.8	48.8	46.2	43.9	41.8	39.9	38.1	36.6	35.1	33.8	32.6	31.5	30.4	29.5	28.6
56	57.3	53.8	50.7	48.0	45.5	43.3	41.4	39.6	37.9	36.5	35.1	33.8	32.7	31.6	30.6	29.7
57	59.5	55.9	52.7	49.8	47.3	45.0	43.0	41.1	39.4	37.9	36.4	35.1	33.9	32.8	31.8	30.8
58	61.8	58.1	54.7	51.8	49.2	46.8	44.7	42.7	41.0	39.3	37.9	36.5	35.3	34.1	33.0	32.0
59	64.3	60.4	56.9	53.9	51.1	48.7	46.4	44.4	42.6	40.9	39.4	38.0	36.7	35.5	34.3	33.3
60	66.9	62.8	59.2	56.1	53.2	50.6	48.3	46.2	44.3	42.6	41.0	39.5	38.2	36.9	35.7	34.6
61	69.7	65.5	61.7	58.4	55.4	52.8	50.3	48.2	46.2	44.4	42.7	41.2	39.7	38.4	37.2	36.1
62	72.7	68.2	64.3	60.9	57.8	55.0	52.5	50.2	48.1	46.2	44.5	42.9	41.4	40.1	38.8	37.6
63	75.8	71.2	67.1	63.5	60.3	57.4	54.8	52.4	50.2	48.3	46.4	44.8	43.2	41.8	40.5	39.3
64	79.2	74.4	70.1	66.4	63.0	60.0	57.2	54.7	52.5	50.4	48.5	46.8	45.2	43.7	42.3	41.0
65	82.9	77.8	73.4	69.4	65.9	62.7	59.8	57.3	54.9	52.7	50.7	48.9	47.2	45.7	44.2	42.9
66	86.8	81.5	76.8	72.7	69.0	65.7	62.7	60.0	57.5	55.2	53.1	51.2	49.5	47.8	46.3	44.9
67	91.0	85.5	80.6	76.2	72.4	68.9	65.7	62.9	60.3	57.9	55.7	53.7	51.9	50.2	48.6	47.1
68	95.6	89.8	84.7	80.1	76.0	72.4	69.1	66.1	63.3	60.9	58.6	56.5	54.5	52.7	51.1	49.5
69	101	94.5	89.1	84.3	80.0	76.2	72.7	69.5	66.7	64.0	61.6	59.4	57.4	55.5	53.7	52.1
70	106	99.7	94.0	88.9	84.4	80.3	76.7	73.3	70.3	67.5	65.0	62.7	60.5	58.5	56.7	54.9
71	112	105	99.3	94.0	89.2	84.9	81.0	77.5	74.3	71.4	68.7	66.3	64.0	61.9	59.9	58.1
72	119	112	105	99.6	94.5	90.0	85.9	82.2	78.8	75.7	72.8	70.2	67.8	65.6	63.5	61.5
73	126	119	112	106	100	95.7	91.3	87.3	83.7	80.4	77.4	74.6	72.1	69.7	67.5	65.4
74	135	127	119	113	107	102	97.3	93.1	89.3	85.7	82.5	79.6	76.8	74.3	71.9	69.7
75	144	135	128	121	115	109	104	99.6	95.5	91.8	88.3	85.2	82.2	79.5	77.0	74.6
	185°	184°	183°	182°	181°	180°	159°	158°	157°	156°	155°	154°	153°	152°	151°	150°
	195°	196°	197°	198°	199°	200°	201°	202°	203°	204°	205°	206°	207°	208°	209°	210°

330°	329°	328°	327°	326°	325°	324°	323°	322°	321°	320°	319°	318°	317°	316°	315°
30°	31°	32°	33°	34°	35°	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3
3	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.5	0.5
4	1.2	1.2	1.1	1.1	1.0	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.8	0.7	0.7
5	1.5	1.5	1.4	1.3	1.3	1.2	1.2	1.1	1.1	1.0	1.0	1.0	0.9	0.9	0.9
6	1.8	1.7	1.7	1.6	1.6	1.5	1.4	1.3	1.3	1.2	1.2	1.2	1.1	1.1	1.1
7	2.1	2.0	2.0	1.9	1.8	1.8	1.7	1.6	1.5	1.5	1.4	1.4	1.3	1.3	1.2
8	2.4	2.3	2.2	2.2	2.1	2.0	1.9	1.9	1.8	1.7	1.6	1.6	1.5	1.5	1.4
9	2.7	2.6	2.5	2.4	2.3	2.3	2.2	2.1	2.0	1.9	1.8	1.8	1.7	1.6	1.6
10	3.1	2.9	2.8	2.7	2.6	2.5	2.4	2.3	2.2	2.1	2.0	2.0	1.9	1.8	1.8
11	3.4	3.2	3.1	3.0	2.9	2.8	2.7	2.6	2.5	2.4	2.3	2.2	2.1	2.0	1.9
12	3.7	3.5	3.4	3.3	3.2	3.0	2.9	2.8	2.7	2.6	2.5	2.4	2.3	2.2	2.1
13	4.0	3.8	3.7	3.6	3.4	3.3	3.2	3.1	3.0	2.9	2.8	2.7	2.6	2.5	2.3
14	4.3	4.1	4.0	3.8	3.7	3.6	3.4	3.3	3.2	3.1	3.0	2.9	2.8	2.7	2.5
15	4.6	4.5	4.3	4.1	4.0	3.8	3.7	3.6	3.4	3.3	3.2	3.1	3.0	2.9	2.7
16	5.0	4.8	4.6	4.4	4.3	4.1	3.9	3.8	3.7	3.5	3.4	3.3	3.2	3.0	2.9
17	5.3	5.1	4.9	4.7	4.5	4.4	4.2	4.1	3.9	3.8	3.6	3.5	3.4	3.3	3.1
18	5.6	5.4	5.2	5.0	4.8	4.6	4.5	4.3	4.2	4.0	3.9	3.7	3.6	3.5	3.2
19	6.0	5.7	5.5	5.3	5.1	4.9	4.7	4.6	4.4	4.3	4.1	4.0	3.8	3.7	3.4
20	6.3	6.1	5.8	5.6	5.4	5.2	5.0	4.8	4.7	4.5	4.3	4.2	4.0	3.9	3.6
21	6.6	6.4	6.1	5.9	5.7	5.5	5.3	5.1	4.9	4.7	4.6	4.4	4.3	4.1	3.8
22	7.0	6.7	6.5	6.2	6.0	5.8	5.6	5.4	5.2	5.0	4.8	4.6	4.5	4.3	4.0
23	7.4	7.1	6.8	6.5	6.3	6.1	5.8	5.6	5.4	5.2	5.1	4.9	4.7	4.6	4.2
24	7.7	7.4	7.1	6.9	6.6	6.4	6.1	5.9	5.7	5.5	5.3	5.1	4.9	4.8	4.5
25	8.1	7.8	7.5	7.2	6.9	6.7	6.4	6.2	6.0	5.8	5.6	5.4	5.2	5.0	4.7
26	8.4	8.1	7.8	7.5	7.2	7.0	6.7	6.5	6.2	6.0	5.8	5.6	5.4	5.2	4.9
27	8.8	8.5	8.2	7.8	7.6	7.3	7.0	6.8	6.5	6.3	6.1	5.9	5.7	5.5	5.1
28	9.2	8.8	8.5	8.2	7.9	7.6	7.3	7.1	6.8	6.6	6.3	6.1	5.9	5.7	5.3
29	9.6	9.2	8.9	8.5	8.2	7.9	7.6	7.4	7.1	6.8	6.6	6.4	6.2	5.9	5.5
30	10.0	9.6	9.2	8.9	8.6	8.2	7.9	7.7	7.4	7.1	6.9	6.6	6.4	6.2	5.8
31	10.4	10.0	9.6	9.3	8.9	8.6	8.3	8.0	7.7	7.4	7.2	6.9	6.7	6.4	6.0
32	10.8	10.4	10.0	9.6	9.3	8.9	8.6	8.3	8.0	7.7	7.4	7.2	6.9	6.7	6.2
33	11.2	10.8	10.4	10.0	9.6	9.3	8.9	8.6	8.3	8.0	7.7	7.5	7.2	7.0	6.5
34	11.7	11.2	10.8	10.4	10.0	9.6	9.3	9.0	8.6	8.3	8.0	7.8	7.5	7.2	6.7
35	12.1	11.7	11.2	10.8	10.4	10.0	9.6	9.3	9.0	8.6	8.3	8.1	7.8	7.5	7.0
36	12.6	12.1	11.6	11.2	10.8	10.4	10.0	9.6	9.3	9.0	8.7	8.4	8.1	7.8	7.3
37	13.1	12.5	12.1	11.6	11.2	10.8	10.4	10.0	9.6	9.3	9.0	8.7	8.4	8.1	7.5
38	13.5	13.0	12.5	12.0	11.6	11.2	10.8	10.4	10.0	9.6	9.3	9.0	8.7	8.4	7.8
39	14.0	13.5	13.0	12.5	12.0	11.6	11.1	10.7	10.4	10.0	9.7	9.3	9.0	8.7	8.1
40	14.5	14.0	13.4	12.9	12.4	12.0	11.5	11.1	10.7	10.4	10.0	9.7	9.3	9.0	8.4
41	15.1	14.5	13.9	13.4	12.9	12.4	12.0	11.5	11.1	10.7	10.4	10.0	9.7	9.3	8.7
42	15.6	15.0	14.4	13.9	13.3	12.9	12.4	11.9	11.5	11.1	10.7	10.4	10.0	9.7	9.0
43	16.2	15.5	14.9	14.4	13.8	13.3	12.8	12.4	11.9	11.5	11.1	10.7	10.4	10.0	9.3
44	16.7	16.1	15.5	14.9	14.3	13.8	13.3	12.8	12.4	11.9	11.5	11.1	10.7	10.4	9.7
45	17.3	16.6	16.0	15.4	14.8	14.3	13.8	13.3	12.8	12.3	11.9	11.5	11.1	10.7	10.0
46	17.9	17.2	16.6	15.9	15.4	14.8	14.3	13.7	13.3	12.8	12.3	11.9	11.5	11.1	10.4
47	18.6	17.8	17.2	16.5	15.9	15.3	14.8	14.2	13.7	13.2	12.8	12.3	11.9	11.5	10.7
48	19.2	18.5	17.8	17.1	16.5	15.9	15.3	14.7	14.2	13.7	13.2	12.8	12.3	11.9	11.1
49	19.9	19.1	18.4	17.7	17.1	16.4	15.8	15.3	14.7	14.2	13.7	13.2	12.8	12.3	11.5
50	20.6	19.8	19.1	18.4	17.7	17.0	16.4	15.8	15.3	14.7	14.2	13.7	13.2	12.8	11.9
51	21.4	20.6	19.8	19.0	18.3	17.6	17.0	16.4	15.8	15.2	14.7	14.2	13.7	13.2	12.3
52	22.2	21.3	20.5	19.7	19.0	18.3	17.6	17.0	16.4	15.8	15.3	14.7	14.2	13.7	12.8
53	23.0	22.1	21.2	20.4	19.7	19.0	18.3	17.6	17.0	16.4	15.8	15.3	14.7	14.2	13.3
54	23.8	22.9	22.0	21.2	20.4	19.7	18.9	18.3	17.6	17.0	16.4	15.8	15.3	14.8	13.8
55	24.7	23.8	22.9	22.0	21.2	20.4	19.7	19.0	18.3	17.6	17.0	16.4	15.9	15.3	14.3
56	25.7	24.7	23.7	22.8	22.0	21.2	20.4	19.7	19.0	18.3	17.7	17.1	16.5	15.9	14.8
57	26.7	25.6	24.6	23.7	22.8	22.0	21.2	20.4	19.7	19.0	18.4	17.7	17.1	16.5	15.4
58	27.7	26.6	25.6	24.6	23.7	22.9	22.0	21.2	20.5	19.8	19.1	18.4	17.8	17.2	16.0
59	28.8	27.7	26.6	25.6	24.7	23.8	22.9	22.1	21.3	20.6	19.8	19.1	18.5	17.8	16.6
60	30.0	28.8	27.7	26.7	25.7	24.7	23.8	23.0	22.2	21.4	20.6	19.9	19.2	18.6	17.3
61	31.3	30.0	28.9	27.8	26.8	25.8	24.8	23.9	23.1	22.3	21.5	20.8	20.0	19.4	18.0
62	32.6	31.3	30.1	29.0	27.9	26.9	25.9	25.0	24.1	23.2	22.4	21.6	20.9	20.2	18.8
63	34.0	32.7	31.4	30.2	29.1	28.0	27.0	26.0	25.1	24.2	23.4	22.6	21.8	21.1	19.6
64	35.5	34.1	32.8	31.6	30.4	29.3	28.2	27.2	26.2	25.3	24.4	23.6	22.8	22.0	20.5
65	37.1	35.7	34.3	33.0	31.8	30.6	29.5	28.5	27.5	26.5	25.6	24.7	23.8	23.0	21.5
66	38.9	37.4	35.9	34.6	33.3	32.1	30.9	29.8	28.7	27.7	26.8	25.8	24.9	24.1	22.5
67	40.8	39.2	37.7	36.3	34.9	33.6	32.4	31.3	30.2	29.1	28.1	27.1	26.2	25.3	23.6
68	42.9	41.2	39.6	38.1	36.7	35.1	34.1	32.8	31.7	30.6	29.5	28.5	27.5	26.5	24.8
69	45.1	43.4	41.7	40.1	38.6	37.2	35.9	34.6	33.4	32.2	31.1	30.0	28.9	27.9	26.1
70	47.6	45.7	44.0	42.3	40.7	39.2	37.8	36.5	35.2	33.9	32.7	31.6	30.4	29.5	27.5
71	50.3	48.3	46.5	44.7	43.1	41.5	40.0	38.5	37.2	35.9	34.6	33.4	32.3	31.1	29.0
72	53.3	51.2	49.3	47.4	45.6	44.0	42.4	40.8	39.4	38.0	36.7	35.4	34.2	33.0	30.8
73	56.7	54.4	52.3	50.4	48.5	46.7	45.0	43.4	41.9	40.4	39.0	37.6	36.3	35.1	32.7
74	60.4	58.0	55.8	53.7	51.7	49.8	48.0	46.3	44.6	43.1	41.6	40.1	38.7	37.4	34.9
75	64.6	62.1	59.7	57.5	55.3	53.3	51.4	49.5	47.8	46.1	44.5	42.9	41.5	40.0	37.3
150°	149°	148°	147°	146°	145°	144°	143°	142°	141°	140°	139°	138°	137°	136°	135°
210°	211°	212°	213°	214°	215°	216°	217°	218°	219°	220°	221°	222°	223°	224°	225°

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	315°	314°	313°	312°	311°	310°	309°	308°	307°	306°	305°	304°	303°	302°	301°	300°
	45°	46°	47°	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	60°
0°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
3	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
4	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
5	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.5
6	1.1	1.0	1.0	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.6	0.6
7	1.2	1.2	1.1	1.1	1.1	1.0	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.8	0.7	0.7
8	1.4	1.4	1.3	1.3	1.2	1.2	1.1	1.1	1.1	1.0	1.0	0.9	0.9	0.9	0.8	0.8
9	1.6	1.5	1.5	1.4	1.4	1.3	1.3	1.2	1.2	1.2	1.1	1.1	1.0	1.0	1.0	0.9
10	1.8	1.7	1.6	1.6	1.5	1.5	1.4	1.4	1.3	1.3	1.2	1.2	1.1	1.1	1.1	1.0
11	1.9	1.9	1.8	1.8	1.7	1.6	1.6	1.5	1.5	1.4	1.4	1.3	1.3	1.2	1.2	1.1
12	2.1	2.1	2.0	1.9	1.8	1.8	1.7	1.7	1.6	1.5	1.5	1.4	1.4	1.3	1.3	1.2
13	2.3	2.2	2.2	2.1	2.0	1.9	1.9	1.8	1.7	1.6	1.5	1.4	1.4	1.3	1.3	1.2
14	2.5	2.4	2.3	2.2	2.2	2.1	2.0	1.9	1.9	1.8	1.7	1.6	1.6	1.5	1.5	1.4
15	2.7	2.6	2.5	2.4	2.3	2.2	2.2	2.1	2.0	1.9	1.9	1.8	1.7	1.6	1.6	1.5
16	2.9	2.8	2.7	2.6	2.5	2.4	2.3	2.2	2.2	2.1	2.0	1.9	1.9	1.8	1.7	1.7
17	3.1	3.0	2.9	2.8	2.7	2.6	2.5	2.4	2.3	2.2	2.1	2.0	2.0	1.9	1.8	1.8
18	3.2	3.1	3.0	2.9	2.8	2.7	2.6	2.5	2.4	2.4	2.3	2.2	2.1	2.0	2.0	1.9
19	3.4	3.3	3.2	3.1	3.0	2.9	2.8	2.7	2.6	2.5	2.4	2.3	2.2	2.1	2.1	2.0
20	3.6	3.5	3.4	3.3	3.2	3.1	2.9	2.8	2.7	2.6	2.5	2.4	2.3	2.2	2.2	2.1
21	3.8	3.7	3.6	3.5	3.3	3.2	3.1	3.0	2.9	2.8	2.7	2.6	2.5	2.4	2.3	2.2
22	4.0	3.9	3.8	3.6	3.5	3.4	3.3	3.2	3.0	2.9	2.8	2.7	2.6	2.5	2.4	2.3
23	4.2	4.1	4.0	3.8	3.7	3.6	3.4	3.3	3.2	3.1	3.0	2.9	2.8	2.7	2.6	2.5
24	4.5	4.3	4.2	4.0	3.9	3.7	3.6	3.5	3.4	3.2	3.1	3.0	2.9	2.8	2.7	2.6
25	4.7	4.5	4.3	4.2	4.1	3.9	3.8	3.6	3.5	3.4	3.3	3.1	3.0	2.9	2.8	2.7
26	4.9	4.7	4.5	4.4	4.2	4.1	3.9	3.8	3.7	3.5	3.4	3.3	3.2	3.0	2.9	2.8
27	5.1	4.9	4.8	4.6	4.4	4.3	4.1	4.0	3.8	3.7	3.6	3.4	3.3	3.2	3.1	2.9
28	5.3	5.1	5.0	4.8	4.6	4.5	4.3	4.2	4.0	3.9	3.7	3.6	3.5	3.3	3.2	3.1
29	5.5	5.4	5.2	5.0	4.8	4.7	4.5	4.3	4.2	4.0	3.9	3.7	3.6	3.5	3.3	3.2
30	5.8	5.6	5.4	5.2	5.0	4.8	4.7	4.5	4.4	4.2	4.0	3.9	3.7	3.6	3.5	3.3
31	6.0	5.8	5.6	5.4	5.2	5.0	4.9	4.7	4.5	4.4	4.2	4.1	3.9	3.8	3.6	3.5
32	6.2	6.0	5.8	5.6	5.4	5.2	5.1	4.9	4.7	4.5	4.4	4.2	4.1	3.9	3.8	3.6
33	6.5	6.3	6.1	5.8	5.6	5.4	5.3	5.1	4.9	4.7	4.5	4.4	4.2	4.1	3.9	3.7
34	6.7	6.5	6.3	6.1	5.9	5.7	5.5	5.3	5.1	4.9	4.7	4.5	4.4	4.2	4.1	3.9
35	7.0	6.8	6.5	6.3	6.1	5.9	5.7	5.5	5.3	5.1	4.9	4.7	4.5	4.4	4.2	4.0
36	7.3	7.0	6.8	6.5	6.3	6.1	5.9	5.7	5.5	5.3	5.1	4.9	4.7	4.5	4.4	4.2
37	7.5	7.3	7.0	6.8	6.6	6.3	6.1	5.9	5.7	5.5	5.3	5.1	4.9	4.7	4.5	4.4
38	7.8	7.5	7.3	7.0	6.8	6.6	6.3	6.1	5.9	5.7	5.5	5.3	5.1	4.9	4.7	4.5
39	8.1	7.8	7.6	7.3	7.0	6.8	6.6	6.3	6.1	5.9	5.7	5.5	5.3	5.1	4.9	4.7
40	8.4	8.1	7.8	7.6	7.3	7.0	6.8	6.6	6.3	6.1	5.9	5.7	5.4	5.2	5.0	4.8
41	8.7	8.4	8.1	7.8	7.6	7.3	7.0	6.8	6.6	6.3	6.1	5.9	5.6	5.4	5.2	5.0
42	9.0	8.7	8.4	8.1	7.8	7.6	7.3	7.0	6.8	6.5	6.3	6.1	5.8	5.6	5.4	5.2
43	9.3	9.0	8.7	8.4	8.1	7.8	7.6	7.3	7.0	6.8	6.5	6.3	6.1	5.8	5.6	5.4
44	9.7	9.3	9.0	8.7	8.4	8.1	7.8	7.5	7.3	7.0	6.8	6.5	6.3	6.0	5.8	5.6
45	10.0	9.7	9.3	9.0	8.7	8.4	8.1	7.8	7.5	7.3	7.0	6.7	6.5	6.2	6.0	5.8
46	10.4	10.0	9.7	9.3	9.0	8.7	8.4	8.1	7.8	7.5	7.3	7.0	6.7	6.5	6.2	6.0
47	10.7	10.4	10.0	9.7	9.3	9.0	8.7	8.4	8.1	7.8	7.5	7.2	7.0	6.7	6.4	6.2
48	11.1	10.7	10.4	10.0	9.7	9.3	9.0	8.7	8.4	8.1	7.8	7.5	7.2	6.9	6.7	6.4
49	11.5	11.1	10.7	10.4	10.0	9.7	9.3	9.0	8.7	8.4	8.1	7.8	7.5	7.2	6.9	6.6
50	11.9	11.5	11.1	10.7	10.4	10.0	9.7	9.3	9.0	8.7	8.3	8.0	7.7	7.4	7.2	6.9
51	12.3	11.9	11.5	11.1	10.7	10.4	10.0	9.6	9.3	9.0	8.6	8.3	8.0	7.7	7.4	7.1
52	12.8	12.4	11.9	11.5	11.1	10.7	10.4	10.0	9.6	9.3	9.0	8.6	8.3	8.0	7.7	7.4
53	13.3	12.8	12.4	11.9	11.5	11.1	10.7	10.4	10.0	9.6	9.3	9.0	8.6	8.3	8.0	7.7
54	13.8	13.3	12.8	12.4	12.0	11.5	11.1	10.8	10.4	10.0	9.6	9.3	8.9	8.6	8.3	7.9
55	14.3	13.8	13.3	12.9	12.4	12.0	11.6	11.2	10.8	10.4	10.0	9.6	9.3	8.9	8.6	8.2
56	14.8	14.3	13.8	13.3	12.9	12.4	12.0	11.6	11.2	10.8	10.4	10.0	9.6	9.3	8.9	8.6
57	15.4	14.9	14.4	13.9	13.4	12.9	12.5	12.0	11.6	11.2	10.8	10.4	10.0	9.6	9.3	8.9
58	16.0	15.5	14.9	14.4	13.9	13.4	13.0	12.5	12.1	11.6	11.2	10.8	10.4	10.0	9.6	9.2
59	16.6	16.1	15.5	15.0	14.5	14.0	13.5	13.0	12.5	12.1	11.7	11.2	10.8	10.4	10.0	9.6
60	17.3	16.7	16.2	15.6	15.1	14.5	14.0	13.5	13.1	12.6	12.1	11.7	11.2	10.8	10.4	10.0
61	18.0	17.4	16.8	16.2	15.7	15.1	14.6	14.1	13.6	13.1	12.6	12.2	11.7	11.3	10.8	10.4
62	18.8	18.2	17.5	16.9	16.4	15.8	15.2	14.7	14.2	13.7	13.2	12.7	12.2	11.8	11.3	10.9
63	19.6	19.0	18.3	17.7	17.1	16.5	15.9	15.3	14.8	14.3	13.7	13.2	12.8	12.3	11.8	11.3
64	20.3	19.8	19.1	18.5	17.8	17.2	16.6	16.0	15.5	14.9	14.4	13.8	13.3	12.8	12.3	11.8
65	21.3	20.7	20.0	19.3	18.6	18.0	17.4	16.8	16.2	15.6	15.0	14.5	13.9	13.4	12.9	12.4
66	22.5	21.7	20.9	20.2	19.5	18.8	18.2	17.5	16.9	16.3	15.7	15.2	14.6	14.0	13.5	13.0
67	23.6	22.8	22.0	21.2	20.5	19.8	19.1	18.4	17.8	17.1	16.5	15.9	15.3	14.7	14.2	13.6
68	24.8	23.9	23.1	22.3	21.5	20.8	20.0	19.3	18.7	18.0	17.3	16.7	16.1	15.5	14.9	14.3
69	26.1	25.2	24.3	23.5	22.6	21.9	21.1	20.4	19.6	18.9	18.2	17.6	16.9	16.3	15.7	15.0
70	27.5	26.5	25.6	24.7	23.9	23.1	22.3	21.5	20.7	20.0	19.2	18.5	17.8	17.2	16.5	15.9
71	29.0	28.0	27.1	26.2	25.2	24.4	23.5	22.7	21.9	21.1	20.3	19.6	18.9	18.2	17.5	16.8
72	30.8	29.7	28.7	27.7	26.8	25.8	24.9	24.1	23.2	22.4	21.6	20.8	20.0	19.2	18.5	17.8
73	32.7	31.6	30.5	29.5	28.4	27.4	26.5	25.6	24.7	23.8	22.9	22.1	21.2	20.4	19.7	18.9
74	34.9	33.7	32.5	31.4	30.3	29.3	28.2	27.3	26.3	25.3	24.4	23.5	22.7	21.8	21.0	20.1
75	37.3	36.0	34.8	33.6	32.4	31.3	30.2	29.2	28.1	27.1	26.1	25.2	24.2	23.3	22.4	21.6
	135°	134°	133°	132°	131°	130°	129°	128°	127°	126°	125°	124°	123°	122°	121°	120°
	225°	226°	227°	228°	229°	230°	231°	232°	233°	234°	235°	236°	237°	238°	239°	240°

3	315°	314°	313°	312°	311°	310°	309°	308°	307°	306°	305°	304°	303°	302°	301°	300°
	45°	46°	47°	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	60°
0°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
3	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6
4	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8
5	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0
6	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.2	1.2
7	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4
8	2.0	2.0	1.9	1.9	1.9	1.8	1.8	1.8	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.6
9	2.2	2.2	2.2	2.1	2.1	2.1	2.0	2.0	2.0	2.0	1.9	1.9	1.9	1.9	1.8	1.8
10	2.5	2.5	2.4	2.4	2.3	2.3	2.3	2.2	2.2	2.2	2.2	2.1	2.1	2.1	2.1	2.0
11	2.7	2.7	2.7	2.6	2.6	2.5	2.5	2.5	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.2
12	3.0	3.0	2.9	2.9	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.6	2.5	2.5	2.5	2.5
13	3.3	3.2	3.2	3.1	3.1	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7
14	3.5	3.5	3.4	3.4	3.3	3.3	3.2	3.2	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.9
15	3.8	3.7	3.7	3.6	3.6	3.5	3.4	3.4	3.4	3.3	3.3	3.2	3.2	3.2	3.1	3.1
16	4.1	4.0	3.9	3.9	3.8	3.7	3.7	3.6	3.6	3.5	3.5	3.5	3.4	3.4	3.3	3.3
17	4.3	4.3	4.2	4.1	4.1	4.0	3.9	3.9	3.8	3.8	3.7	3.7	3.6	3.6	3.6	3.5
18	4.6	4.5	4.4	4.4	4.3	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.8
19	4.9	4.8	4.7	4.6	4.6	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0
20	5.1	5.1	5.0	4.9	4.8	4.8	4.7	4.6	4.6	4.5	4.4	4.4	4.3	4.3	4.2	4.2
21	5.4	5.3	5.2	5.2	5.1	5.0	4.9	4.9	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4
22	5.7	5.6	5.5	5.4	5.4	5.3	5.2	5.1	5.1	5.0	4.9	4.9	4.8	4.8	4.7	4.7
23	6.0	5.9	5.8	5.7	5.6	5.5	5.5	5.4	5.3	5.2	5.2	5.1	5.1	5.0	5.0	4.8
24	6.3	6.2	6.1	6.0	5.9	5.8	5.7	5.6	5.6	5.5	5.4	5.4	5.3	5.3	5.2	5.1
25	6.6	6.5	6.4	6.3	6.2	6.1	6.0	5.9	5.8	5.8	5.7	5.6	5.6	5.5	5.4	5.4
26	6.9	6.8	6.7	6.6	6.5	6.4	6.3	6.2	6.1	6.0	6.0	5.9	5.8	5.8	5.7	5.6
27	7.2	7.1	7.0	6.9	6.8	6.7	6.6	6.5	6.4	6.3	6.2	6.1	6.1	6.0	5.9	5.9
28	7.5	7.4	7.3	7.2	7.0	6.9	6.8	6.7	6.7	6.6	6.5	6.4	6.3	6.3	6.2	6.1
29	7.8	7.7	7.6	7.5	7.3	7.2	7.1	7.0	6.9	6.9	6.8	6.7	6.6	6.5	6.5	6.4
30	8.2	8.0	7.9	7.8	7.6	7.5	7.4	7.3	7.2	7.1	7.0	7.0	6.9	6.8	6.7	6.7
31	8.5	8.4	8.2	8.1	8.0	7.8	7.7	7.6	7.5	7.4	7.3	7.2	7.2	7.1	7.0	6.9
32	8.8	8.7	8.5	8.4	8.3	8.2	8.0	7.9	7.8	7.7	7.6	7.5	7.4	7.4	7.3	7.2
33	9.2	9.0	8.9	8.7	8.6	8.5	8.4	8.2	8.1	8.0	7.9	7.8	7.7	7.7	7.6	7.5
34	9.5	9.4	9.2	9.1	8.9	8.8	8.7	8.6	8.4	8.3	8.2	8.1	8.0	8.0	7.9	7.8
35	9.9	9.7	9.6	9.4	9.3	9.1	9.0	8.9	8.8	8.7	8.5	8.4	8.3	8.3	8.2	8.1
36	10.3	10.1	9.9	9.8	9.6	9.5	9.3	9.2	9.1	9.0	8.9	8.8	8.7	8.6	8.5	8.4
37	10.7	10.5	10.3	10.1	10.0	9.8	9.7	9.6	9.4	9.3	9.2	9.1	9.0	8.9	8.8	8.7
38	11.0	10.9	10.7	10.5	10.4	10.2	10.1	9.9	9.8	9.7	9.5	9.4	9.3	9.2	9.1	9.0
39	11.5	11.3	11.1	10.9	10.7	10.6	10.4	10.3	10.1	10.0	9.9	9.8	9.7	9.5	9.4	9.4
40	11.9	11.7	11.5	11.3	11.1	11.0	10.8	10.6	10.5	10.4	10.2	10.1	10.0	9.9	9.8	9.7
41	12.3	12.1	11.9	11.7	11.5	11.3	11.2	11.0	10.9	10.7	10.6	10.5	10.4	10.3	10.1	10.0
42	12.7	12.5	12.3	12.1	11.9	11.8	11.6	11.4	11.3	11.1	11.0	10.9	10.7	10.6	10.5	10.4
43	13.2	13.0	12.8	12.5	12.4	12.2	12.0	11.8	11.7	11.5	11.4	11.2	11.1	11.0	10.9	10.8
44	13.7	13.4	13.2	13.0	12.8	12.6	12.4	12.3	12.1	11.9	11.8	11.6	11.5	11.4	11.3	11.2
45	14.1	13.9	13.7	13.5	13.3	13.1	12.9	12.7	12.5	12.4	12.2	12.1	11.9	11.8	11.7	11.5
46	14.6	14.4	14.2	13.9	13.7	13.5	13.3	13.1	13.0	12.8	12.6	12.5	12.3	12.2	12.1	12.0
47	15.2	14.9	14.7	14.4	14.2	14.0	13.8	13.6	13.4	13.3	13.1	12.9	12.8	12.6	12.5	12.4
48	15.7	15.4	15.2	14.9	14.7	14.5	14.3	14.1	13.9	13.7	13.6	13.4	13.2	13.1	13.0	12.8
49	16.3	16.0	15.7	15.5	15.2	15.0	14.8	14.6	14.4	14.2	14.0	13.9	13.7	13.6	13.4	13.3
50	16.9	16.6	16.3	16.0	15.8	15.6	15.3	15.1	14.9	14.7	14.5	14.4	14.2	14.1	13.9	13.8
51	17.5	17.2	16.9	16.6	16.4	16.1	15.9	15.7	15.5	15.3	15.1	14.9	14.7	14.6	14.4	14.3
52	18.1	17.8	17.5	17.2	17.0	16.7	16.5	16.2	16.0	15.8	15.6	15.4	15.3	15.1	14.9	14.8
53	18.8	18.4	18.1	17.9	17.6	17.3	17.1	16.8	16.6	16.4	16.2	16.0	15.8	15.6	15.5	15.3
54	19.5	19.1	18.8	18.5	18.2	18.0	17.7	17.5	17.2	17.0	16.8	16.6	16.4	16.3	16.1	15.9
55	20.2	19.9	19.5	19.2	18.9	18.6	18.4	18.1	17.9	17.7	17.4	17.2	17.0	16.8	16.7	16.5
56	21.0	20.6	20.3	19.9	19.6	19.4	19.1	18.8	18.6	18.3	18.1	17.9	17.7	17.5	17.3	17.1
57	21.8	21.4	21.1	20.7	20.4	20.1	19.8	19.5	19.3	19.0	18.8	18.6	18.4	18.2	18.0	17.8
58	22.6	22.2	21.9	21.5	21.2	20.9	20.6	20.3	20.0	19.8	19.5	19.3	19.1	18.9	18.7	18.5
59	23.5	23.1	22.8	22.4	22.1	21.7	21.4	21.1	20.8	20.6	20.3	20.1	19.8	19.6	19.4	19.2
60	24.5	24.1	23.7	23.3	22.9	22.6	22.3	22.0	21.7	21.4	21.1	20.9	20.7	20.4	20.2	20.0
61	25.5	25.1	24.7	24.3	23.9	23.6	23.2	22.9	22.6	22.3	22.0	21.8	21.5	21.3	21.1	20.8
62	26.6	26.2	25.7	25.3	24.9	24.6	24.2	23.9	23.6	23.3	23.0	22.7	22.4	22.2	21.9	21.7
63	27.8	27.3	26.8	26.4	26.0	25.6	25.3	24.9	24.6	24.3	24.0	23.7	23.4	23.1	22.9	22.7
64	29.0	28.5	28.0	27.6	27.2	26.8	26.4	26.0	25.7	25.3	25.0	24.7	24.5	24.2	23.9	23.7
65	30.3	29.8	29.3	28.9	28.4	28.0	27.6	27.2	26.9	26.5	26.2	25.9	25.6	25.3	25.0	24.8
66	31.8	31.2	30.7	30.2	29.8	29.3	28.9	28.5	28.1	27.8	27.4	27.1	26.8	26.5	26.2	25.9
67	33.3	32.8	32.2	31.7	31.2	30.8	30.3	29.9	29.5	29.1	28.8	28.4	28.1	27.8	27.5	27.2
68	35.0	34.4	33.8	33.3	32.8	32.3	31.8	31.4	31.0	30.6	30.2	29.9	29.5	29.2	28.9	28.6
69	36.8	36.2	35.6	35.1	34.5	34.0	33.5	33.1	32.6	32.2	31.8	31.4	31.1	30.7	30.4	30.1
70	38.9	38.2	37.6	37.0	36.4	35.9	35.4	34.9	34.4	34.0	33.5	33.1	32.8	32.4	32.0	31.7
71	41.1	40.4	39.7	39.1	38.5	37.9	37.4	36.8	36.4	35.9	35.4	35.0	34.6	34.2	33.9	33.5
72	43.5	42.8	42.1	41.4	40.8	40.2	39.6	39.1	38.5	38.0	37.6	37.1	36.7	36.3	35.9	35.5
73	46.3	45.5	44.7	44.0	43.3	42.7	42.1	41.5	41.0	40.4	39.9	39.5	39.0	38.6	38.2	37.8
74	49.3	48.5	47.7	46.9	46.2	45.5	44.9	44.3	43.7	43.1	42.6	42.1	41.6	41.1	40.7	40.3
75	52.8	51.9	51.0	50.2	49.5	48.7	48.0	47.4	46.7	46.1	45.6	45.0	44.5	44.0	43.5	43.1
135°	134°	133°	132°	131°	130°	129°	128°	127°	126°	125°	124°	123°	122°	121°	120°	
225°	226°	227°	228°	229°	230°	231°	232°	233°	234°	235°	236°	237°	238°	239°	240°	

(3)

	300°	299°	298°	297°	296°	295°	294°	293°	292°	291°	290°	289°	288°	287°	286°	285°
	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	72°	73°	74°	75°
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3
6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
7	0.7	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4
8	0.8	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.4
9	0.9	0.9	0.8	0.8	0.8	0.7	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5
10	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5
11	1.1	1.1	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.6	0.6	0.6	0.5
12	1.2	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.6
13	1.3	1.3	1.2	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.8	0.8	0.8	0.7	0.7	0.6
14	1.4	1.4	1.3	1.3	1.2	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.8	0.8	0.7	0.7
15	1.5	1.5	1.4	1.4	1.3	1.2	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.8	0.8	0.7
16	1.7	1.6	1.5	1.5	1.4	1.3	1.3	1.2	1.2	1.1	1.0	1.0	0.9	0.9	0.8	0.8
17	1.8	1.7	1.6	1.6	1.5	1.4	1.4	1.3	1.2	1.2	1.1	1.1	1.0	0.9	0.9	0.8
18	1.9	1.8	1.7	1.7	1.6	1.5	1.4	1.4	1.3	1.2	1.2	1.1	1.1	1.0	0.9	0.9
19	2.0	1.9	1.8	1.8	1.7	1.6	1.5	1.5	1.4	1.3	1.3	1.2	1.1	1.1	1.0	0.9
20	2.1	2.0	1.9	1.9	1.8	1.7	1.6	1.5	1.5	1.4	1.3	1.3	1.2	1.1	1.0	1.0
21	2.2	2.1	2.0	2.0	1.9	1.8	1.7	1.6	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0
22	2.3	2.2	2.1	2.1	2.0	1.9	1.8	1.7	1.6	1.6	1.5	1.4	1.3	1.2	1.2	1.1
23	2.5	2.4	2.3	2.2	2.1	2.0	1.9	1.8	1.7	1.6	1.5	1.5	1.4	1.3	1.2	1.1
24	2.6	2.5	2.4	2.3	2.2	2.1	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.4	1.3	1.2
25	2.7	2.6	2.5	2.4	2.3	2.2	2.1	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2
26	2.8	2.7	2.6	2.5	2.4	2.3	2.2	2.1	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3
27	2.9	2.8	2.7	2.6	2.5	2.4	2.3	2.2	2.1	2.0	1.9	1.8	1.7	1.6	1.5	1.4
28	3.1	2.9	2.8	2.7	2.6	2.5	2.4	2.3	2.1	2.0	1.9	1.8	1.7	1.6	1.5	1.4
29	3.2	3.1	2.9	2.8	2.7	2.6	2.5	2.4	2.2	2.1	2.0	1.9	1.8	1.7	1.6	1.5
30	3.3	3.2	3.1	2.9	2.8	2.7	2.6	2.5	2.3	2.2	2.1	2.0	1.9	1.8	1.7	1.5
31	3.5	3.3	3.2	3.1	2.9	2.8	2.7	2.6	2.4	2.3	2.2	2.1	1.9	1.8	1.7	1.6
32	3.6	3.5	3.3	3.2	3.0	2.9	2.8	2.7	2.5	2.4	2.3	2.2	2.0	1.9	1.8	1.7
33	3.7	3.6	3.5	3.3	3.2	3.0	2.9	2.8	2.6	2.5	2.4	2.2	2.1	2.0	1.9	1.7
34	3.9	3.7	3.6	3.4	3.3	3.1	3.0	2.9	2.7	2.6	2.5	2.3	2.2	2.1	1.9	1.8
35	4.0	3.9	3.7	3.6	3.4	3.3	3.1	3.0	2.8	2.7	2.5	2.4	2.3	2.1	2.0	1.9
36	4.2	4.0	3.9	3.7	3.5	3.4	3.2	3.1	2.9	2.8	2.6	2.5	2.4	2.2	2.1	1.9
37	4.4	4.2	4.0	3.8	3.7	3.5	3.4	3.2	3.0	2.9	2.7	2.6	2.5	2.3	2.2	2.0
38	4.5	4.3	4.2	4.0	3.8	3.6	3.5	3.3	3.2	3.0	2.8	2.7	2.6	2.4	2.2	2.1
39	4.7	4.5	4.3	4.1	3.9	3.8	3.6	3.4	3.3	3.1	2.9	2.8	2.6	2.5	2.3	2.2
40	4.8	4.7	4.5	4.3	4.1	3.9	3.7	3.6	3.4	3.2	3.1	2.9	2.7	2.6	2.4	2.2
41	5.0	4.8	4.6	4.4	4.2	4.1	3.9	3.7	3.5	3.3	3.2	3.0	2.8	2.7	2.5	2.3
42	5.2	5.0	4.8	4.6	4.4	4.2	4.0	3.8	3.6	3.5	3.3	3.1	2.9	2.8	2.6	2.4
43	5.4	5.2	5.0	4.8	4.5	4.3	4.2	4.0	3.8	3.6	3.4	3.2	3.0	2.9	2.7	2.5
44	5.6	5.4	5.1	4.9	4.7	4.5	4.3	4.1	3.9	3.7	3.5	3.3	3.1	3.0	2.8	2.6
45	5.8	5.5	5.3	5.1	4.9	4.7	4.5	4.2	4.0	3.8	3.6	3.4	3.2	3.1	2.9	2.7
46	6.0	5.7	5.5	5.3	5.1	4.8	4.6	4.4	4.2	4.0	3.8	3.6	3.4	3.2	3.0	2.8
47	6.2	5.9	5.7	5.5	5.2	5.0	4.8	4.6	4.3	4.1	3.9	3.7	3.5	3.3	3.1	2.9
48	6.4	6.2	5.9	5.7	5.4	5.2	4.9	4.7	4.5	4.3	4.0	3.8	3.6	3.4	3.2	3.0
49	6.6	6.4	6.1	5.9	5.6	5.4	5.1	4.9	4.6	4.4	4.2	4.0	3.7	3.5	3.3	3.1
50	6.9	6.6	6.3	6.1	5.8	5.6	5.3	5.1	4.8	4.6	4.3	4.1	3.9	3.6	3.4	3.2
51	7.1	6.8	6.6	6.3	6.0	5.8	5.5	5.2	5.0	4.7	4.5	4.3	4.0	3.8	3.5	3.3
52	7.4	7.1	6.8	6.5	6.2	6.0	5.7	5.4	5.2	4.9	4.7	4.4	4.2	3.9	3.7	3.4
53	7.7	7.4	7.1	6.8	6.5	6.2	5.9	5.6	5.4	5.1	4.8	4.6	4.3	4.1	3.8	3.6
54	7.9	7.6	7.3	7.0	6.7	6.4	6.1	5.8	5.6	5.3	5.0	4.7	4.5	4.2	3.9	3.7
55	8.2	7.9	7.6	7.3	7.0	6.7	6.4	6.1	5.8	5.5	5.2	4.9	4.6	4.4	4.1	3.8
56	8.6	8.2	7.9	7.6	7.2	6.9	6.6	6.3	6.0	5.7	5.4	5.1	4.8	4.5	4.3	4.0
57	8.9	8.5	8.2	7.8	7.5	7.2	6.9	6.5	6.2	5.9	5.6	5.3	5.0	4.7	4.4	4.1
58	9.2	8.9	8.5	8.2	7.8	7.5	7.1	6.8	6.5	6.1	5.8	5.5	5.2	4.9	4.6	4.3
59	9.6	9.2	8.8	8.5	8.1	7.8	7.4	7.1	6.7	6.4	6.1	5.7	5.4	5.1	4.8	4.5
60	10.0	9.6	9.2	8.8	8.4	8.1	7.7	7.4	7.0	6.6	6.3	6.0	5.6	5.3	5.0	4.6
61	10.4	10.0	9.6	9.2	8.8	8.4	8.0	7.7	7.3	6.9	6.6	6.2	5.9	5.5	5.2	4.8
62	10.9	10.4	10.0	9.6	9.2	8.8	8.4	8.0	7.6	7.2	6.9	6.5	6.1	5.8	5.4	5.0
63	11.3	10.9	10.4	10.0	9.6	9.2	8.7	8.3	7.9	7.5	7.2	6.8	6.4	6.0	5.6	5.3
64	11.8	11.4	10.9	10.5	10.0	9.6	9.1	8.7	8.3	7.9	7.5	7.1	6.7	6.3	5.9	5.5
65	12.4	11.9	11.4	10.9	10.5	10.0	9.6	9.1	8.7	8.2	7.8	7.4	7.0	6.6	6.2	5.8
66	13.0	12.5	11.9	11.4	11.0	10.5	10.0	9.5	9.1	8.6	8.2	7.7	7.3	6.9	6.4	6.0
67	13.6	13.1	12.5	12.0	11.5	11.0	10.5	10.0	9.5	9.0	8.6	8.1	7.7	7.2	6.8	6.3
68	14.3	13.7	13.2	12.6	12.1	11.5	10.9	10.5	10.0	9.5	9.0	8.5	8.0	7.6	7.1	6.6
69	15.0	14.4	13.9	13.3	12.7	12.2	11.6	11.1	10.5	10.0	9.5	9.0	8.5	8.0	7.5	7.0
70	15.9	15.2	14.6	14.0	13.4	12.8	12.2	11.7	11.1	10.5	10.0	9.5	8.9	8.4	7.9	7.4
71	16.8	16.1	15.4	14.8	14.2	13.5	12.9	12.3	11.7	11.1	10.6	10.0	9.4	8.9	8.3	7.8
72	17.8	17.1	16.4	15.7	15.0	14.4	13.7	13.1	12.4	11.8	11.2	10.6	10.0	9.4	8.8	8.2
73	18.9	18.1	17.4	16.7	16.0	15.3	14.6	13.9	13.2	12.6	11.9	11.3	10.6	10.0	9.4	8.8
74	20.1	19.3	18.5	17.8	17.0	16.3	15.5	14.8	14.1	13.4	12.7	12.0	11.3	10.7	10.0	9.3
75	21.6	20.7	19.8	19.0	18.2	17.4	16.6	15.8	15.1	14.3	13.6	12.9	12.1	11.4	10.7	10.0
	120°	119°	118°	117°	116°	115°	114°	113°	112°	111°	110°	109°	108°	107°	106°	105°
	240°	241°	242°	243°	244°	245°	246°	247°	248°	249°	250°	251°	252°	253°	254°	255°

300°	299°	298°	297°	296°	295°	294°	293°	292°	291°	290°	289°	288°	287°	286°	285°
60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	72°	73°	74°	75°
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
3	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5
4	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7
5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
6	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
7	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
8	1.6	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
9	1.8	1.8	1.8	1.8	1.8	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.6
10	2.0	2.0	2.0	2.0	2.0	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.8	1.8	1.8
11	2.2	2.2	2.2	2.2	2.2	2.1	2.1	2.1	2.1	2.1	2.1	2.0	2.0	2.0	2.0
12	2.5	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.3	2.2	2.2	2.2	2.2	2.2
13	2.7	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.4
14	2.9	2.9	2.8	2.8	2.8	2.8	2.7	2.7	2.7	2.7	2.6	2.6	2.6	2.6	2.6
15	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.9	2.9	2.9	2.8	2.8	2.8	2.8	2.8
16	3.3	3.3	3.2	3.2	3.2	3.1	3.1	3.1	3.1	3.1	3.0	3.0	3.0	3.0	3.0
17	3.5	3.5	3.5	3.4	3.4	3.4	3.3	3.3	3.3	3.3	3.2	3.2	3.2	3.2	3.2
18	3.8	3.7	3.7	3.6	3.6	3.6	3.5	3.5	3.5	3.5	3.4	3.4	3.4	3.4	3.4
19	4.0	3.9	3.9	3.9	3.8	3.8	3.7	3.7	3.7	3.7	3.6	3.6	3.6	3.6	3.6
20	4.2	4.2	4.1	4.1	4.0	4.0	4.0	3.9	3.9	3.9	3.8	3.8	3.8	3.8	3.8
21	4.4	4.4	4.3	4.3	4.3	4.2	4.2	4.1	4.1	4.1	4.1	4.0	4.0	4.0	4.0
22	4.7	4.6	4.6	4.5	4.5	4.5	4.4	4.4	4.3	4.3	4.3	4.2	4.2	4.2	4.2
23	4.9	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.5	4.4	4.4	4.4	4.4
24	5.1	5.1	5.0	5.0	5.0	4.9	4.9	4.8	4.8	4.7	4.7	4.7	4.6	4.6	4.6
25	5.4	5.3	5.3	5.2	5.2	5.1	5.1	5.0	5.0	5.0	4.9	4.9	4.9	4.9	4.8
26	5.6	5.6	5.5	5.5	5.4	5.4	5.3	5.3	5.2	5.2	5.1	5.1	5.1	5.1	5.0
27	5.9	5.8	5.8	5.7	5.7	5.6	5.6	5.5	5.5	5.4	5.4	5.4	5.3	5.3	5.3
28	6.1	6.1	6.0	6.0	5.9	5.9	5.8	5.8	5.7	5.7	5.6	5.6	5.6	5.5	5.5
29	6.4	6.3	6.3	6.2	6.2	6.1	6.1	6.0	5.9	5.9	5.9	5.8	5.8	5.8	5.7
30	6.7	6.6	6.5	6.5	6.4	6.4	6.3	6.2	6.2	6.1	6.1	6.1	6.0	6.0	6.0
31	6.9	6.9	6.8	6.7	6.7	6.6	6.6	6.5	6.4	6.4	6.4	6.3	6.3	6.3	6.2
32	7.2	7.1	7.1	7.0	6.9	6.8	6.8	6.7	6.7	6.6	6.6	6.6	6.5	6.5	6.5
33	7.5	7.4	7.4	7.3	7.2	7.1	7.1	7.0	7.0	6.9	6.9	6.8	6.8	6.8	6.7
34	7.8	7.7	7.6	7.6	7.5	7.4	7.4	7.3	7.2	7.2	7.1	7.1	7.1	7.0	7.0
35	8.1	8.0	7.9	7.9	7.8	7.7	7.7	7.6	7.5	7.5	7.4	7.4	7.3	7.3	7.2
36	8.4	8.3	8.2	8.2	8.1	8.0	8.0	7.9	7.8	7.7	7.7	7.6	7.6	7.5	7.5
37	8.7	8.6	8.5	8.5	8.4	8.3	8.2	8.1	8.1	8.0	8.0	7.9	7.9	7.8	7.8
38	9.0	8.9	8.8	8.8	8.7	8.6	8.6	8.5	8.4	8.4	8.3	8.3	8.2	8.1	8.1
39	9.4	9.3	9.2	9.1	9.0	8.9	8.9	8.8	8.7	8.6	8.6	8.5	8.5	8.4	8.4
40	9.7	9.6	9.5	9.4	9.3	9.3	9.2	9.1	9.0	8.9	8.9	8.8	8.8	8.7	8.7
41	10.0	9.9	9.8	9.8	9.7	9.6	9.5	9.4	9.3	9.3	9.2	9.1	9.1	9.0	9.0
42	10.4	10.3	10.2	10.1	10.0	9.9	9.9	9.8	9.7	9.6	9.6	9.5	9.4	9.4	9.3
43	10.8	10.7	10.6	10.5	10.4	10.3	10.2	10.1	10.1	10.0	9.9	9.9	9.8	9.7	9.7
44	11.2	11.0	10.9	10.8	10.7	10.7	10.6	10.5	10.4	10.3	10.2	10.2	10.1	10.0	10.0
45	11.5	11.4	11.3	11.2	11.1	11.0	10.9	10.9	10.8	10.7	10.6	10.6	10.5	10.4	10.4
46	12.0	11.8	11.7	11.6	11.5	11.4	11.3	11.2	11.2	11.1	11.0	10.9	10.8	10.8	10.7
47	12.4	12.3	12.1	12.0	11.9	11.8	11.7	11.6	11.6	11.5	11.4	11.3	11.2	11.2	11.1
48	12.8	12.7	12.6	12.5	12.4	12.3	12.2	12.1	12.0	11.9	11.8	11.7	11.6	11.6	11.5
49	13.3	13.2	13.0	12.9	12.8	12.7	12.6	12.5	12.4	12.3	12.2	12.2	12.1	12.0	11.9
50	13.8	13.6	13.5	13.4	13.3	13.1	13.0	12.9	12.9	12.8	12.7	12.6	12.5	12.4	12.3
51	14.3	14.1	14.0	13.9	13.7	13.6	13.5	13.4	13.3	13.2	13.1	13.0	12.9	12.8	12.8
52	14.8	14.6	14.5	14.4	14.2	14.1	14.0	13.9	13.8	13.7	13.6	13.5	13.4	13.3	13.3
53	15.3	15.2	15.0	14.9	14.8	14.6	14.5	14.4	14.3	14.2	14.1	14.0	13.9	13.8	13.7
54	15.9	15.7	15.6	15.4	15.3	15.2	15.1	15.0	14.8	14.7	14.6	14.5	14.4	14.3	14.2
55	16.5	16.3	16.2	16.0	15.9	15.8	15.6	15.5	15.4	15.3	15.2	15.1	15.0	14.9	14.8
56	17.1	17.0	16.8	16.6	16.5	16.4	16.2	16.1	16.0	15.9	15.8	15.7	15.6	15.5	15.3
57	17.8	17.6	17.4	17.3	17.1	17.0	16.9	16.7	16.6	16.5	16.4	16.3	16.2	16.1	16.0
58	18.5	18.3	18.1	18.0	17.8	17.7	17.5	17.4	17.3	17.1	17.0	16.9	16.8	16.7	16.6
59	19.2	19.0	18.8	18.7	18.5	18.4	18.2	18.1	17.9	17.8	17.7	17.6	17.5	17.4	17.3
60	20.0	19.8	19.6	19.4	19.3	19.1	19.0	18.8	18.7	18.6	18.4	18.3	18.2	18.1	17.9
61	20.8	20.6	20.4	20.3	20.1	19.9	19.8	19.6	19.5	19.3	19.2	19.1	19.0	18.9	18.7
62	21.7	21.5	21.3	21.1	20.9	20.8	20.6	20.4	20.3	20.2	20.0	19.9	19.8	19.7	19.5
63	22.7	22.4	22.2	22.0	21.8	21.7	21.5	21.3	21.2	21.0	20.9	20.8	20.6	20.5	20.3
64	23.7	23.4	23.2	23.0	22.8	22.6	22.4	22.3	22.1	22.0	21.8	21.7	21.6	21.4	21.2
65	24.8	24.5	24.3	24.1	23.9	23.7	23.5	23.3	23.1	23.0	22.8	22.7	22.6	22.4	22.2
66	25.9	25.7	25.4	25.2	25.0	24.8	24.6	24.4	24.2	24.1	23.9	23.8	23.6	23.4	23.3
67	27.2	26.9	26.7	26.4	26.2	26.0	25.8	25.6	25.4	25.2	25.1	24.9	24.8	24.6	24.4
68	28.6	28.3	28.0	27.8	27.5	27.3	27.1	26.9	26.7	26.5	26.3	26.2	26.0	25.9	25.6
69	30.1	29.8	29.5	29.2	29.0	28.7	28.5	28.3	28.1	27.9	27.7	27.6	27.4	27.2	27.0
70	31.7	31.4	31.1	30.8	30.6	30.3	30.1	29.8	29.6	29.4	29.2	29.1	28.9	28.7	28.4
71	33.5	33.2	32.9	32.6	32.3	32.0	31.8	31.6	31.3	31.1	30.9	30.7	30.5	30.4	30.1
72	35.5	35.2	34.9	34.5	34.2	34.0	33.7	33.4	33.2	33.0	32.8	32.6	32.4	32.2	31.9
73	37.8	37.4	37.0	36.7	36.4	36.1	35.8	35.5	35.3	35.0	34.8	34.6	34.4	34.2	33.9
74	40.3	39.9	39.5	39.1	38.8	38.5	38.2	37.9	37.6	37.4	37.1	36.9	36.7	36.5	36.1
75	43.1	42.7	42.3	41.9	41.5	41.2	40.9	40.5	40.3	40.0	39.7	39.5	39.2	39.0	38.6
120°	119°	118°	117°	116°	115°	114°	113°	112°	111°	110°	109°	108°	107°	106°	105°
240°	241°	242°	243°	244°	245°	246°	247°	248°	249°	250°	251°	252°	253°	254°	255°

A (3)

	285°	284°	283°	282°	281°	280°	279°	278°	277°	276°	275°	274°	273°	272°	271°	270°
	75°	76°	77°	78°	79°	80°	81°	82°	83°	84°	85°	86°	87°	88°	89°	90°
0°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
4	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
5	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
6	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
7	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0
8	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0
9	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.0	0.0
10	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.0	0.0
11	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.0	0.0
12	0.6	0.5	0.5	0.5	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.0	0.0
13	0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.1	0.1	0.0	0.0
14	0.7	0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.1	0.1	0.0	0.0
15	0.7	0.7	0.6	0.6	0.5	0.5	0.4	0.4	0.3	0.3	0.2	0.3	0.1	0.1	0.0	0.0
16	0.8	0.7	0.7	0.6	0.6	0.5	0.5	0.4	0.4	0.3	0.3	0.2	0.2	0.1	0.1	0.0
17	0.8	0.8	0.7	0.6	0.6	0.5	0.5	0.4	0.4	0.3	0.3	0.2	0.2	0.1	0.1	0.0
18	0.9	0.8	0.8	0.7	0.6	0.6	0.5	0.5	0.4	0.3	0.3	0.2	0.2	0.1	0.1	0.0
19	0.9	0.9	0.8	0.7	0.7	0.6	0.5	0.5	0.4	0.4	0.3	0.2	0.2	0.1	0.1	0.0
20	1.0	0.9	0.8	0.8	0.7	0.6	0.6	0.5	0.4	0.4	0.3	0.3	0.2	0.1	0.1	0.0
21	1.0	1.0	0.9	0.8	0.7	0.7	0.6	0.5	0.5	0.4	0.3	0.3	0.2	0.1	0.1	0.0
22	1.1	1.0	0.9	0.9	0.8	0.7	0.6	0.6	0.5	0.4	0.4	0.3	0.2	0.1	0.1	0.0
23	1.1	1.1	1.0	0.9	0.8	0.7	0.7	0.6	0.5	0.4	0.4	0.3	0.2	0.1	0.1	0.0
24	1.2	1.1	1.0	0.9	0.9	0.8	0.7	0.6	0.5	0.5	0.4	0.3	0.2	0.2	0.1	0.0
25	1.2	1.2	1.1	1.0	0.9	0.8	0.7	0.7	0.6	0.5	0.4	0.3	0.2	0.2	0.1	0.0
26	1.3	1.2	1.1	1.0	0.9	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.2	0.1	0.0
27	1.4	1.3	1.2	1.1	1.0	0.9	0.8	0.7	0.6	0.5	0.4	0.4	0.3	0.2	0.1	0.0
28	1.4	1.3	1.2	1.1	1.0	0.9	0.8	0.7	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0.0
29	1.5	1.4	1.3	1.2	1.1	1.0	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0.0
30	1.5	1.4	1.3	1.2	1.1	1.0	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0.0
31	1.6	1.5	1.4	1.3	1.2	1.1	1.0	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0.0
32	1.7	1.6	1.4	1.3	1.2	1.1	1.0	0.9	0.8	0.7	0.5	0.4	0.3	0.2	0.1	0.0
33	1.7	1.6	1.5	1.4	1.3	1.1	1.0	0.9	0.8	0.7	0.6	0.5	0.3	0.2	0.1	0.0
34	1.8	1.7	1.6	1.4	1.3	1.2	1.1	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.1	0.0
35	1.9	1.7	1.6	1.5	1.4	1.2	1.1	1.0	0.9	0.7	0.6	0.5	0.4	0.2	0.1	0.0
36	1.9	1.8	1.7	1.5	1.4	1.3	1.2	1.0	0.9	0.8	0.6	0.5	0.4	0.3	0.1	0.0
37	2.0	1.9	1.7	1.6	1.5	1.3	1.2	1.1	0.9	0.8	0.7	0.5	0.4	0.3	0.1	0.0
38	2.1	1.9	1.8	1.7	1.5	1.4	1.2	1.1	1.0	0.8	0.7	0.5	0.4	0.3	0.1	0.0
39	2.2	2.0	1.9	1.7	1.6	1.4	1.3	1.1	1.0	0.9	0.7	0.6	0.4	0.3	0.1	0.0
40	2.2	2.1	1.9	1.8	1.6	1.5	1.3	1.2	1.0	0.9	0.7	0.6	0.4	0.3	0.1	0.0
41	2.3	2.2	2.0	1.8	1.7	1.5	1.4	1.2	1.1	0.9	0.8	0.6	0.5	0.3	0.2	0.0
42	2.4	2.2	2.1	1.9	1.8	1.6	1.4	1.3	1.1	0.9	0.8	0.6	0.5	0.3	0.2	0.0
43	2.5	2.3	2.2	2.0	1.8	1.6	1.5	1.3	1.1	1.0	0.8	0.7	0.5	0.3	0.2	0.0
44	2.6	2.4	2.2	2.1	1.9	1.7	1.5	1.4	1.2	1.0	0.8	0.7	0.5	0.3	0.2	0.0
45	2.7	2.5	2.3	2.1	1.9	1.8	1.6	1.4	1.2	1.1	0.9	0.7	0.5	0.3	0.2	0.0
46	2.8	2.6	2.4	2.2	2.0	1.8	1.6	1.5	1.3	1.1	0.9	0.7	0.5	0.4	0.2	0.0
47	2.9	2.7	2.5	2.3	2.1	1.9	1.7	1.5	1.3	1.1	0.9	0.7	0.6	0.4	0.2	0.0
48	3.0	2.8	2.6	2.4	2.2	2.0	1.8	1.6	1.4	1.2	1.0	0.8	0.6	0.4	0.2	0.0
49	3.1	2.9	2.7	2.4	2.2	2.0	1.8	1.6	1.4	1.2	1.0	0.8	0.6	0.4	0.2	0.0
50	3.2	3.0	2.8	2.5	2.3	2.1	1.9	1.7	1.5	1.3	1.0	0.8	0.6	0.4	0.2	0.0
51	3.3	3.1	2.9	2.6	2.4	2.2	2.0	1.7	1.5	1.3	1.1	0.9	0.6	0.4	0.2	0.0
52	3.4	3.2	3.0	2.7	2.5	2.3	2.0	1.8	1.6	1.3	1.1	0.9	0.7	0.4	0.2	0.0
53	3.6	3.3	3.1	2.8	2.6	2.3	2.1	1.9	1.6	1.4	1.2	0.9	0.7	0.5	0.2	0.0
54	3.7	3.4	3.2	2.9	2.7	2.4	2.2	1.9	1.7	1.4	1.2	1.0	0.7	0.5	0.2	0.0
55	3.8	3.6	3.3	3.0	2.8	2.5	2.3	2.0	1.8	1.5	1.2	1.0	0.7	0.5	0.2	0.0
56	4.0	3.7	3.4	3.2	2.9	2.6	2.3	2.1	1.8	1.6	1.3	1.0	0.8	0.5	0.3	0.0
57	4.1	3.8	3.6	3.3	3.0	2.7	2.4	2.2	1.9	1.6	1.3	1.1	0.8	0.5	0.3	0.0
58	4.3	4.0	3.7	3.4	3.1	2.8	2.5	2.2	2.0	1.7	1.4	1.1	0.8	0.6	0.3	0.0
59	4.5	4.1	3.8	3.5	3.2	2.9	2.6	2.3	2.0	1.7	1.5	1.2	0.9	0.6	0.3	0.0
60	4.6	4.3	4.0	3.7	3.4	3.1	2.7	2.4	2.1	1.8	1.5	1.2	0.9	0.6	0.3	0.0
61	4.8	4.5	4.2	3.8	3.5	3.2	2.9	2.5	2.2	1.9	1.6	1.3	1.0	0.6	0.3	0.0
62	5.0	4.7	4.3	4.0	3.7	3.3	3.0	2.6	2.3	2.0	1.7	1.3	1.0	0.7	0.3	0.0
63	5.3	4.9	4.5	4.2	3.8	3.5	3.1	2.8	2.4	2.1	1.7	1.4	1.0	0.7	0.3	0.0
64	5.5	5.1	4.7	4.4	4.0	3.6	3.3	2.9	2.5	2.2	1.8	1.4	1.1	0.7	0.4	0.0
65	5.8	5.4	5.0	4.6	4.2	3.8	3.4	3.0	2.6	2.3	1.9	1.5	1.1	0.8	0.4	0.0
66	6.0	5.6	5.2	4.8	4.4	4.0	3.6	3.2	2.8	2.4	2.0	1.6	1.2	0.8	0.4	.00
67	6.3	5.9	5.4	5.0	4.6	4.2	3.7	3.3	2.9	2.5	2.1	1.7	1.2	0.8	0.4	.00
68	6.6	6.2	5.7	5.3	4.8	4.4	3.9	3.5	3.0	2.6	2.2	1.7	1.3	0.9	0.4	.00
69	7.0	6.5	6.0	5.5	5.1	4.6	4.1	3.7	3.2	2.7	2.3	1.8	1.4	0.9	0.5	.00
70	7.4	6.9	6.3	5.8	5.3	4.8	4.4	3.9	3.4	2.9	2.4	1.9	1.4	1.0	0.5	.00
71	7.8	7.2	6.7	6.2	5.7	5.1	4.6	4.1	3.6	3.1	2.5	2.0	1.5	1.0	0.5	.00
72	8.2	7.7	7.1	6.5	6.0	5.4	4.9	4.3	3.8	3.2	2.7	2.2	1.6	1.1	0.5	.00
73	8.8	8.2	7.6	7.0	6.4	5.8	5.2	4.6	4.0	3.4	2.9	2.3	1.7	1.1	0.6	.00
74	9.3	8.7	8.1	7.4	6.8	6.1	5.5	4.9	4.3	3.7	3.1	2.4	1.8	1.2	0.6	.00
75	10.0	9.3	8.6	7.9	7.3	6.6	5.9	5.3	4.6	3.9	3.3	2.6	2.0	1.3	0.7	.00
	105°	104°	103°	102°	101°	100°	99°	98°	97°	96°	95°	94°	93°	92°	91°	90°
	255°	256°	257°	258°	259°	260°	261°	262°	263°	264°	265°	266°	267°	268°	269°	270°

③	285°	284°	283°	282°	281°	280°	279°	278°	277°	276°	275°	274°	273°	272°	271°	270°
	75°	76°	77°	78°	79°	80°	81°	82°	83°	84°	85°	86°	87°	88°	89°	90°
0°	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3
3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
4	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
5	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
6	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
7	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
8	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
9	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
10	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
11	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.9	1.9	1.9	1.9	1.9
12	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
13	2.4	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
14	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
15	2.8	2.8	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
16	3.0	3.0	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
17	3.2	3.2	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
18	3.4	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.2	3.2
19	3.6	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.4	3.4	3.4	3.4
20	3.8	3.8	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.6	3.6	3.6	3.6	3.6
21	4.0	4.0	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.8	3.8	3.8	3.8	3.8
22	4.2	4.2	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.0	4.0	4.0	4.0	4.0
23	4.4	4.4	4.4	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.2	4.2	4.2
24	4.6	4.6	4.6	4.6	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
25	4.8	4.8	4.8	4.8	4.8	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7
26	5.0	5.0	5.0	5.0	5.0	5.0	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
27	5.3	5.3	5.2	5.2	5.2	5.2	5.2	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
28	5.5	5.5	5.5	5.4	5.4	5.4	5.4	5.4	5.4	5.3	5.3	5.3	5.3	5.3	5.3	5.3
29	5.7	5.7	5.7	5.7	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.5	5.5	5.5
30	6.0	5.9	5.9	5.9	5.9	5.9	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
31	6.2	6.2	6.2	6.1	6.1	6.1	6.1	6.1	6.1	6.0	6.0	6.0	6.0	6.0	6.0	6.0
32	6.5	6.4	6.4	6.4	6.4	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.2	6.2
33	6.7	6.7	6.7	6.6	6.6	6.6	6.6	6.6	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
34	7.0	7.0	6.9	6.9	6.9	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.7	6.7	6.7
35	7.2	7.2	7.2	7.2	7.1	7.1	7.1	7.1	7.1	7.0	7.0	7.0	7.0	7.0	7.0	7.0
36	7.5	7.5	7.5	7.4	7.4	7.4	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
37	7.8	7.8	7.7	7.7	7.7	7.7	7.6	7.6	7.6	7.6	7.6	7.6	7.5	7.5	7.5	7.5
38	8.1	8.1	8.0	8.0	8.0	7.9	7.9	7.9	7.9	7.9	7.8	7.8	7.8	7.8	7.8	7.8
39	8.4	8.3	8.3	8.3	8.2	8.2	8.2	8.2	8.2	8.1	8.1	8.1	8.1	8.1	8.1	8.1
40	8.7	8.6	8.6	8.6	8.5	8.5	8.5	8.5	8.5	8.4	8.4	8.4	8.4	8.4	8.4	8.4
41	9.0	9.0	8.9	8.9	8.9	8.8	8.8	8.8	8.8	8.7	8.7	8.7	8.7	8.7	8.7	8.7
42	9.3	9.3	9.2	9.2	9.2	9.1	9.1	9.1	9.1	9.1	9.0	9.0	9.0	9.0	9.0	9.0
43	9.7	9.6	9.6	9.5	9.5	9.5	9.4	9.4	9.4	9.4	9.4	9.3	9.3	9.3	9.3	9.3
44	10.0	10.0	9.9	9.9	9.8	9.8	9.8	9.8	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
45	10.3	10.3	10.3	10.2	10.2	10.2	10.1	10.1	10.1	10.1	10.0	10.0	10.0	10.0	10.0	10.0
46	10.7	10.7	10.6	10.6	10.6	10.5	10.5	10.5	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4
47	11.1	11.1	11.0	11.0	10.9	10.9	10.9	10.8	10.8	10.8	10.8	10.7	10.7	10.7	10.7	10.7
48	11.5	11.4	11.4	11.4	11.3	11.3	11.2	11.2	11.2	11.2	11.1	11.1	11.1	11.1	11.1	11.1
49	11.9	11.9	11.8	11.8	11.7	11.7	11.6	11.6	11.6	11.6	11.5	11.5	11.5	11.5	11.5	11.5
50	12.3	12.3	12.2	12.2	12.1	12.1	12.1	12.0	12.0	12.0	12.0	11.9	11.9	11.9	11.9	11.9
51	12.8	12.7	12.7	12.6	12.6	12.5	12.5	12.5	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.3
52	13.3	13.2	13.1	13.1	13.0	13.0	13.0	12.9	12.9	12.9	12.8	12.8	12.8	12.8	12.8	12.8
53	13.7	13.7	13.6	13.6	13.5	13.5	13.4	13.4	13.4	13.3	13.3	13.3	13.3	13.3	13.3	13.3
54	14.2	14.2	14.1	14.1	14.0	14.0	13.9	13.9	13.9	13.8	13.8	13.8	13.8	13.8	13.8	13.8
55	14.8	14.7	14.7	14.6	14.5	14.5	14.5	14.4	14.4	14.4	14.3	14.3	14.3	14.3	14.3	14.3
56	15.3	15.3	15.2	15.2	15.1	15.1	15.0	15.0	14.9	14.9	14.9	14.9	14.8	14.8	14.8	14.8
57	15.9	15.9	15.8	15.7	15.7	15.6	15.6	15.6	15.5	15.5	15.5	15.4	15.4	15.4	15.4	15.4
58	16.6	16.5	16.4	16.4	16.3	16.3	16.2	16.2	16.1	16.1	16.1	16.0	16.0	16.0	16.0	16.0
59	17.2	17.2	17.1	17.0	17.0	16.9	16.9	16.8	16.8	16.7	16.7	16.7	16.7	16.7	16.6	16.6
60	17.9	17.9	17.8	17.7	17.6	17.6	17.5	17.5	17.5	17.4	17.4	17.4	17.3	17.3	17.3	17.3
61	18.7	18.6	18.5	18.4	18.4	18.3	18.3	18.2	18.2	18.1	18.1	18.1	18.1	18.1	18.0	18.0
62	19.5	19.4	19.3	19.2	19.2	19.1	19.0	19.0	19.0	18.9	18.9	18.9	18.8	18.8	18.8	18.8
63	20.3	20.2	20.1	20.1	20.0	20.0	19.9	19.8	19.8	19.7	19.7	19.7	19.6	19.6	19.6	19.6
64	21.2	21.1	21.0	21.0	20.9	20.8	20.8	20.7	20.7	20.6	20.6	20.5	20.5	20.5	20.5	20.5
65	22.2	22.1	22.0	21.9	21.9	21.8	21.7	21.7	21.6	21.6	21.5	21.5	21.5	21.5	21.5	21.5
66	23.3	23.1	23.1	23.0	22.9	22.8	22.7	22.7	22.6	22.6	22.5	22.5	22.5	22.5	22.5	22.5
67	24.4	24.3	24.2	24.1	24.0	23.9	23.9	23.8	23.7	23.7	23.6	23.6	23.6	23.6	23.6	23.6
68	25.6	25.5	25.4	25.3	25.2	25.1	25.1	25.0	24.9	24.9	24.8	24.8	24.8	24.8	24.8	24.8
69	27.0	26.8	26.7	26.6	26.5	26.5	26.4	26.3	26.2	26.2	26.2	26.1	26.1	26.1	26.1	26.1
70	28.4	28.3	28.2	28.1	28.0	27.9	27.8	27.8	27.7	27.6	27.6	27.5	27.5	27.5	27.5	27.5
71	30.1	29.9	29.8	29.7	29.6	29.5	29.4	29.3	29.3	29.2	29.2	29.1	29.1	29.0	29.0	29.0
72	31.9	31.7	31.6	31.5	31.4	31.3	31.2	31.1	31.0	30.9	30.9	30.8	30.8	30.8	30.8	30.8
73	33.9	33.7	33.6	33.4	33.3	33.2	33.1	33.0	33.0	32.9	32.8	32.8	32.8	32.7	32.7	32.7
74	36.1	35.9	35.8	35.7	35.5	35.4	35.3	35.2	35.1	35.1	35.0	35.0	34.9	34.9	34.9	34.9
75	38.6	38.5	38.3	38.2	38.0	37.9	37.8	37.7	37.6	37.5	37.5	37.4	37.4	37.3	37.3	37.3
	105°	104°	103°	102°	101°	100°	99°	98°	97°	96°	95°	94°	93°	92°	91°	90°
	255°	256°	257°	258°	259°	260°	261°	262°	263°	264°	265°	266°	267°	268°	269°	270°

3

	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
0	90.0	89.4	88.9	88.3	87.7	87.1	86.6	86.0	85.4	84.9	84.3	83.7	83.2	82.6	82.0	81.5
2	90.0	89.4	88.9	88.3	87.7	87.1	86.6	86.0	85.4	84.9	84.3	83.7	83.2	82.6	82.0	81.5
4	90.0	89.4	88.9	88.3	87.7	87.1	86.6	86.0	85.4	84.9	84.3	83.7	83.2	82.6	82.0	81.5
6	90.0	89.4	88.9	88.3	87.7	87.2	86.6	86.0	85.5	84.9	84.3	83.8	83.2	82.6	82.1	81.5
8	90.0	89.4	88.9	88.3	87.7	87.2	86.6	86.0	85.5	84.9	84.3	83.8	83.2	82.7	82.1	81.6
10	90.0	89.4	88.9	88.3	87.7	87.2	86.6	86.1	85.5	84.9	84.4	83.8	83.3	82.7	82.1	81.6
11	90.0	89.4	88.9	88.3	87.7	87.2	86.6	86.1	85.5	85.0	84.4	83.8	83.3	82.7	82.2	81.7
12	90.0	89.4	88.9	88.3	87.8	87.2	86.6	86.1	85.5	85.0	84.4	83.9	83.3	82.8	82.2	81.7
13	90.0	89.4	88.9	88.3	87.8	87.2	86.7	86.1	85.5	85.0	84.4	83.9	83.3	82.8	82.2	81.7
14	90.0	89.4	88.9	88.3	87.8	87.2	86.7	86.1	85.6	85.0	84.5	83.9	83.4	82.8	82.3	81.7
16	90.0	89.4	88.9	88.3	87.8	87.2	86.7	86.1	85.6	85.0	84.5	83.9	83.4	82.9	82.3	81.8
16	90.0	89.4	88.9	88.3	87.8	87.2	86.7	86.2	85.6	85.1	84.5	84.0	83.5	82.9	82.4	81.9
17	90.0	89.4	88.9	88.4	87.8	87.3	86.7	86.2	85.6	85.1	84.5	84.0	83.5	83.0	82.4	81.9
18	90.0	89.5	88.9	88.4	87.8	87.3	86.7	86.2	85.6	85.1	84.5	84.0	83.5	83.0	82.5	82.0
19	90.0	89.5	88.9	88.4	87.8	87.3	86.8	86.2	85.7	85.1	84.6	84.1	83.5	83.0	82.5	82.0
20	90.0	89.5	88.9	88.4	87.8	87.3	86.8	86.2	85.7	85.2	84.6	84.1	83.6	83.0	82.5	82.0
21	90.0	89.5	88.9	88.4	87.9	87.3	86.8	86.3	85.7	85.2	84.7	84.1	83.6	83.1	82.6	82.1
22	90.0	89.5	88.9	88.4	87.9	87.3	86.8	86.3	85.8	85.2	84.7	84.2	83.7	83.1	82.6	82.1
23	90.0	89.5	88.9	88.4	87.9	87.4	86.8	86.3	85.8	85.3	84.7	84.2	83.7	83.2	82.7	82.2
24	90.0	89.5	89.0	88.4	87.9	87.4	86.9	86.3	85.8	85.3	84.8	84.3	83.7	83.2	82.7	82.2
25	90.0	89.5	89.0	88.4	87.9	87.4	86.9	86.4	85.9	85.3	84.8	84.3	83.8	83.3	82.8	82.3
26	90.0	89.5	89.0	88.5	87.9	87.4	86.9	86.4	85.9	85.4	84.9	84.4	83.9	83.4	82.9	82.4
27	90.0	89.5	89.0	88.5	88.0	87.5	87.0	86.5	86.0	85.5	85.0	84.5	84.0	83.5	83.0	82.5
28	90.0	89.5	89.0	88.5	88.0	87.5	87.0	86.5	86.0	85.5	85.0	84.5	84.0	83.5	83.0	82.5
29	90.0	89.5	89.0	88.5	88.0	87.5	87.0	86.5	86.0	85.5	85.0	84.5	84.0	83.5	83.0	82.5
30	90.0	89.5	89.0	88.5	88.0	87.5	87.0	86.5	86.0	85.5	85.1	84.6	84.1	83.6	83.1	82.6
31	90.0	89.5	89.0	88.5	88.0	87.5	87.1	86.6	86.1	85.6	85.1	84.6	84.1	83.6	83.1	82.7
32	90.0	89.5	89.0	88.5	88.1	87.6	87.1	86.6	86.1	85.6	85.2	84.7	84.2	83.7	83.2	82.8
33	90.0	89.5	89.0	88.6	88.1	87.6	87.1	86.6	86.2	85.7	85.2	84.7	84.3	83.8	83.3	82.8
34	90.0	89.5	89.1	88.6	88.1	87.6	87.2	86.7	86.2	85.7	85.3	84.8	84.3	83.8	83.4	82.9
35	90.0	89.5	89.1	88.6	88.1	87.7	87.2	86.7	86.3	85.8	85.3	84.9	84.4	83.9	83.5	83.0
36	90.0	89.5	89.1	88.6	88.1	87.7	87.2	86.8	86.3	85.8	85.4	84.9	84.5	84.0	83.5	83.1
37	90.0	89.5	89.1	88.6	88.2	87.7	87.3	86.8	86.3	85.9	85.4	85.0	84.5	84.1	83.6	83.2
38	90.0	89.5	89.1	88.6	88.2	87.7	87.3	86.8	86.4	85.9	85.5	85.0	84.6	84.2	83.7	83.3
39	90.0	89.6	89.1	88.7	88.2	87.8	87.3	86.9	86.4	86.0	85.6	85.1	84.7	84.2	83.8	83.4
40	90.0	89.6	89.1	88.7	88.2	87.8	87.4	86.9	86.5	86.1	85.6	85.2	84.7	84.3	83.9	83.4
41	90.0	89.6	89.1	88.7	88.3	87.8	87.4	87.0	86.5	86.1	85.7	85.3	84.8	84.4	84.0	83.5
42	90.0	89.6	89.1	88.7	88.3	87.9	87.4	87.0	86.6	86.2	85.7	85.3	84.9	84.5	84.1	83.6
43	90.0	89.6	89.2	88.7	88.3	87.9	87.5	87.1	86.7	86.2	85.8	85.4	85.0	84.6	84.2	83.7
44	90.0	89.6	89.2	88.8	88.4	87.9	87.5	87.1	86.7	86.3	85.9	85.5	85.1	84.7	84.2	83.8
45	90.0	89.6	89.2	88.8	88.4	88.0	87.6	87.2	86.8	86.4	86.0	85.6	85.1	84.7	84.3	83.9
46	90.0	89.6	89.2	88.8	88.4	88.0	87.6	87.2	86.8	86.4	86.0	85.6	85.2	84.8	84.4	84.1
47	90.0	89.6	89.2	88.8	88.4	88.0	87.7	87.3	86.9	86.5	86.1	85.7	85.3	84.9	84.5	84.2
48	90.0	89.6	89.2	88.9	88.5	88.1	87.7	87.3	86.9	86.6	86.2	85.8	85.4	85.0	84.6	84.3
49	90.0	89.6	89.2	88.9	88.5	88.1	87.7	87.4	87.0	86.6	86.2	85.9	85.5	85.1	84.8	84.4
50	90.0	89.6	89.3	88.9	88.5	88.2	87.8	87.4	87.1	86.7	86.3	86.0	85.6	85.2	84.9	84.5
51	90.0	89.6	89.3	88.9	88.6	88.2	87.8	87.5	87.1	86.8	86.4	86.0	85.7	85.3	85.0	84.6
52	90.0	89.6	89.3	88.9	88.6	88.2	87.9	87.5	87.2	86.8	86.5	86.1	85.8	85.4	85.1	84.7
53	90.0	89.7	89.3	89.0	88.6	88.3	87.9	87.6	87.2	86.9	86.6	86.2	85.9	85.5	85.2	84.8
54	90.0	89.7	89.3	89.0	88.7	88.3	88.0	87.6	87.3	87.0	86.6	86.3	86.0	85.6	85.3	85.0
55	90.0	89.7	89.3	89.0	88.7	88.4	88.0	87.7	87.4	87.0	86.7	86.4	86.1	85.7	85.4	85.1
56	90.0	89.7	89.4	89.0	88.7	88.4	88.1	87.8	87.4	87.1	86.8	86.5	86.2	85.8	85.5	85.2
57	90.0	89.7	89.4	89.1	88.8	88.4	88.1	87.8	87.5	87.2	86.9	86.6	86.3	86.0	85.6	85.3
58	90.0	89.7	89.4	89.1	88.8	88.5	88.2	87.9	87.6	87.3	87.0	86.7	86.4	86.1	85.8	85.5
59	90.0	89.7	89.4	89.1	88.8	88.5	88.2	87.9	87.6	87.3	87.1	86.8	86.5	86.2	85.9	85.6
60	90.0	89.7	89.4	89.1	88.9	88.6	88.3	88.0	87.7	87.4	87.1	86.9	86.6	86.3	86.0	85.7
61	90.0	89.7	89.4	89.2	88.9	88.6	88.3	88.1	87.8	87.5	87.2	86.9	86.7	86.4	86.1	85.8
62	90.0	89.7	89.5	89.2	88.9	88.7	88.4	88.1	87.8	87.6	87.3	87.0	86.8	86.5	86.2	86.0
63	90.0	89.7	89.5	89.2	89.0	88.7	88.4	88.2	87.9	87.7	87.4	87.1	86.9	86.6	86.4	86.1
64	90.0	89.7	89.5	89.2	89.0	88.7	88.5	88.2	88.0	87.7	87.5	87.2	87.0	86.7	86.5	86.2
65	90.0	89.8	89.5	89.3	89.0	88.8	88.5	88.3	88.1	87.8	87.6	87.3	87.1	86.9	86.6	86.4
66	90.0	89.8	89.5	89.3	89.1	88.8	88.6	88.4	88.1	87.9	87.7	87.4	87.2	87.0	86.7	86.5
67	90.0	89.8	89.6	89.3	89.1	88.9	88.7	88.4	88.2	88.0	87.8	87.5	87.3	87.1	86.9	86.6
68	90.0	89.8	89.6	89.4	89.1	88.9	88.7	88.5	88.3	88.1	87.9	87.6	87.4	87.2	87.0	86.8
69	90.0	89.8	89.6	89.4	89.2	89.0	88.8	88.6	88.4	88.2	88.0	87.7	87.5	87.3	87.1	86.9
70	90.0	89.8	89.6	89.4	89.2	89.0	88.8	88.6	88.4	88.2	88.0	87.8	87.7	87.5	87.3	87.1
71	90.0	89.8	89.6	89.4	89.3	89.1	88.9	88.7	88.5	88.3	88.1	87.9	87.8	87.6	87.4	87.2
72	90.0	89.8	89.6	89.5	89.3	89.1	88.9	88.8	88.6	88.4	88.2	88.1	87.9	87.7	87.5	87.3
73	90.0	89.8	89.7	89.5	89.3	89.2	89.0	88.8	88.7	88.5	88.3	88.2	88.0	87.8	87.7	87.5
74	90.0	89.8	89.7	89.5	89.4	89.2	89.0	88.9	88.7	88.6	88.4	88.3	88.1	87.9	87.8	87.6
75	90.0	89.9	89.7	89.6	89.4	89.3	89.1	89.0	88.8	88.7	88.5	88.4	88.2	88.1	87.9	87.8

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	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
0	81.5	80.9	80.4	79.8	79.2	78.7	78.1	77.6	77.0	76.5	76.0	75.4	74.9	74.4	73.8	73.3
1	81.5	80.9	80.4	79.8	79.2	78.7	78.1	77.6	77.1	76.5	76.0	75.4	74.9	74.4	73.8	73.3
2	81.5	80.9	80.4	79.8	79.3	78.7	78.2	77.6	77.1	76.5	76.0	75.3	74.9	74.4	73.9	73.3
3	81.5	81.0	80.4	79.8	79.3	78.8	78.2	77.7	77.1	76.6	76.0	75.5	75.0	74.4	73.9	73.4
4	81.6	81.0	80.4	79.9	79.3	78.8	78.3	77.7	77.2	76.6	76.1	75.6	75.0	74.5	74.0	73.5
5	81.6	81.0	80.5	79.9	79.4	78.9	78.3	77.8	77.2	76.7	76.2	75.6	75.1	74.6	74.1	73.5
6	81.6	81.1	80.5	80.0	79.4	78.9	78.4	77.8	77.3	76.7	76.2	75.7	75.2	74.6	74.1	73.6
7	81.7	81.1	80.6	80.0	79.5	78.9	78.4	77.9	77.3	76.8	76.3	75.7	75.2	74.7	74.2	73.6
8	81.7	81.1	80.6	80.1	79.5	79.0	78.4	77.9	77.4	76.8	76.3	75.8	75.3	74.7	74.2	73.7
9	81.7	81.2	80.6	80.1	79.6	79.0	78.5	78.0	77.4	76.9	76.4	75.8	75.3	74.8	74.3	73.8
10	81.8	81.2	80.7	80.1	79.6	79.1	78.5	78.0	77.5	76.9	76.4	75.9	75.4	74.9	74.4	73.8
11	81.8	81.3	80.7	80.2	79.6	79.1	78.6	78.1	77.5	77.0	76.5	76.0	75.5	74.9	74.4	73.9
12	81.9	81.3	80.8	80.2	79.7	79.2	78.6	78.1	77.6	77.1	76.6	76.0	75.5	75.0	74.5	74.0
13	81.9	81.3	80.8	80.3	79.8	79.2	78.7	78.2	77.7	77.1	76.6	76.1	75.6	75.1	74.6	74.1
14	82.0	81.4	80.9	80.3	79.8	79.3	78.8	78.2	77.7	77.2	76.7	76.2	75.7	75.2	74.7	74.2
15	82.0	81.4	80.9	80.4	79.9	79.4	78.8	78.3	77.8	77.3	76.8	76.3	75.8	75.3	74.8	74.3
16	82.1	81.5	81.0	80.5	79.9	79.4	78.9	78.4	77.9	77.4	76.9	76.4	75.9	75.3	74.9	74.4
17	82.1	81.6	81.0	80.5	80.0	79.5	79.0	78.5	78.0	77.5	76.9	76.4	75.9	75.4	75.0	74.5
18	82.2	81.6	81.1	80.6	80.1	79.6	79.1	78.6	78.0	77.5	77.0	76.5	76.0	75.5	75.1	74.6
19	82.2	81.7	81.2	80.7	80.2	79.6	79.1	78.6	78.1	77.6	77.1	76.6	76.1	75.7	75.2	74.7
20	82.3	81.7	81.2	80.7	80.2	79.7	79.2	78.7	78.2	77.7	77.2	76.7	76.2	75.8	75.3	74.8
21	82.3	81.8	81.3	80.8	80.3	79.8	79.3	78.8	78.3	77.8	77.3	76.8	76.4	75.9	75.4	74.9
22	82.4	81.9	81.4	80.9	80.4	79.9	79.4	78.9	78.4	77.9	77.4	77.0	76.5	76.0	75.5	75.0
23	82.5	82.0	81.5	81.0	80.5	80.0	79.5	79.0	78.5	78.0	77.6	77.1	76.6	76.1	75.6	75.1
24	82.5	82.0	81.5	81.1	80.6	80.1	79.6	79.1	78.6	78.1	77.7	77.2	76.7	76.2	75.8	75.3
25	82.6	82.1	81.6	81.1	80.7	80.2	79.7	79.2	78.7	78.3	77.8	77.3	76.8	76.4	75.9	75.4
26	82.7	82.2	81.7	81.2	80.7	80.3	79.8	79.3	78.8	78.4	77.9	77.4	77.0	76.5	76.0	75.5
27	82.8	82.3	81.8	81.3	80.8	80.4	79.9	79.4	79.0	78.5	78.0	77.6	77.1	76.6	76.2	75.7
28	82.8	82.4	81.9	81.4	80.9	80.5	80.0	79.5	79.1	78.6	78.2	77.7	77.2	76.8	76.3	75.9
29	82.9	82.4	82.0	81.5	81.0	80.6	80.1	79.7	79.2	78.7	78.3	77.8	77.4	76.9	76.5	76.0
30	83.0	82.5	82.1	81.6	81.2	80.7	80.2	79.8	79.3	78.9	78.4	78.0	77.5	77.1	76.6	76.2
31	83.1	82.6	82.2	81.7	81.3	80.8	80.4	79.9	79.5	79.0	78.6	78.1	77.7	77.2	76.8	76.4
32	83.2	82.7	82.3	81.8	81.4	80.9	80.5	80.0	79.6	79.1	78.7	78.3	77.8	77.4	77.0	76.5
33	83.3	82.8	82.4	81.9	81.5	81.0	80.6	80.2	79.7	79.3	78.9	78.4	78.0	77.6	77.1	76.7
34	83.4	82.9	82.5	82.0	81.6	81.2	80.7	80.3	79.9	79.4	79.0	78.6	78.1	77.7	77.3	76.9
35	83.4	83.0	82.6	82.1	81.7	81.3	80.9	80.4	80.0	79.6	79.2	78.7	78.3	77.9	77.5	77.1
36	83.5	83.1	82.7	82.3	81.8	81.4	81.0	80.6	80.2	79.7	79.3	78.9	78.5	78.1	77.7	77.2
37	83.6	83.2	82.8	82.4	82.0	81.5	81.1	80.7	80.3	79.9	79.5	79.1	78.7	78.2	77.8	77.4
38	83.7	83.3	82.9	82.5	82.1	81.7	81.3	80.9	80.5	80.0	79.6	79.2	78.8	78.4	78.0	77.6
39	83.8	83.4	83.0	82.6	82.2	81.8	81.4	81.0	80.6	80.2	79.8	79.4	79.0	78.6	78.2	77.8
40	83.9	83.5	83.1	82.7	82.3	82.0	81.6	81.2	80.8	80.4	80.0	79.6	79.2	78.8	78.4	78.0
41	84.1	83.7	83.3	82.9	82.5	82.1	81.7	81.3	80.9	80.5	80.1	79.8	79.4	79.0	78.6	78.2
42	84.2	83.8	83.4	83.0	82.6	82.2	81.8	81.5	81.1	80.7	80.3	79.9	79.6	79.2	78.8	78.4
43	84.3	83.9	83.5	83.1	82.8	82.4	82.0	81.6	81.3	80.9	80.5	80.1	79.8	79.4	79.0	78.6
44	84.4	84.0	83.6	83.3	82.9	82.5	82.2	81.8	81.4	81.1	80.7	80.3	80.0	79.6	79.2	78.9
45	84.5	84.1	83.8	83.4	83.0	82.7	82.3	82.0	81.6	81.2	80.9	80.5	80.2	79.8	79.4	79.1
46	84.6	84.3	83.9	83.5	83.2	82.8	82.5	82.1	81.8	81.4	81.1	80.7	80.4	80.0	79.7	79.3
47	84.7	84.4	84.0	83.7	83.3	83.0	82.6	82.3	81.9	81.6	81.2	80.9	80.6	80.2	79.9	79.5
48	84.8	84.5	84.2	83.8	83.5	83.1	82.8	82.5	82.1	81.8	81.4	81.1	80.8	80.4	80.1	79.8
49	85.0	84.6	84.3	84.0	83.6	83.3	83.0	82.6	82.3	82.0	81.6	81.3	81.0	80.7	80.3	80.0
50	85.1	84.8	84.4	84.1	83.8	83.5	83.1	82.8	82.5	82.2	81.8	81.5	81.2	80.9	80.6	80.2
51	85.2	84.9	84.6	84.3	83.9	83.6	83.3	83.0	82.7	82.4	82.0	81.7	81.4	81.1	80.8	80.5
52	85.3	85.0	84.7	84.4	84.1	83.8	83.5	83.2	82.9	82.6	82.2	81.9	81.6	81.3	81.0	80.7
53	85.5	85.2	84.9	84.6	84.3	84.0	83.7	83.4	83.1	82.8	82.5	82.2	81.9	81.6	81.3	81.0
54	85.6	85.3	85.0	84.7	84.4	84.1	83.8	83.5	83.2	83.0	82.7	82.4	82.1	81.8	81.5	81.2
55	85.7	85.4	85.1	84.9	84.6	84.3	84.0	83.7	83.4	83.2	82.9	82.6	82.3	82.0	81.7	81.5
56	85.8	85.6	85.3	85.0	84.7	84.5	84.2	83.9	83.6	83.4	83.1	82.8	82.5	82.3	82.0	81.7
57	86.0	85.7	85.4	85.2	84.9	84.6	84.4	84.1	83.8	83.6	83.3	83.0	82.8	82.5	82.2	82.0
58	86.1	85.8	85.6	85.3	85.1	84.8	84.6	84.3	84.0	83.8	83.5	83.3	83.0	82.8	82.5	82.2
59	86.2	86.0	85.7	85.5	85.2	85.0	84.7	84.5	84.2	84.0	83.7	83.5	83.2	83.0	82.8	82.5
60	86.4	86.1	85.9	85.6	85.4	85.2	84.9	84.7	84.4	84.2	84.0	83.7	83.5	83.3	83.0	82.8
61	86.5	86.3	86.0	85.8	85.6	85.3	85.1	84.9	84.7	84.4	84.2	84.0	83.7	83.5	83.3	83.0
62	86.6	86.4	86.2	86.0	85.8	85.5	85.3	85.1	84.9	84.6	84.4	84.2	84.0	83.8	83.5	83.3
63	86.8	86.6	86.4	86.1	85.9	85.7	85.5	85.3	85.1	84.9	84.6	84.4	84.2	84.0	83.8	83.6
64	86.9	86.7	86.5	86.3	86.1	85.9	85.7	85.5	85.3	85.1	84.9	84.7	84.5	84.3	84.1	83.9
65	87.1	86.9	86.7	86.5	86.3	86.1	85.9	85.7	85.5	85.3	85.1	84.9	84.7	84.5	84.3	84.1
66	87.2	87.0	86.8	86.6	86.5	86.3	86.1	85.9	85.7	85.5	85.3	85.2	85.0	84.8	84.6	84.4
67	87.3	87.2	87.0	86.8	86.6	86.5	86.3	86.1	85.9	85.8	85.6	85.4	85.2	85.1	84.9	84.7
68	87.5	87.3	87.2	87.0	86.8	86.7	86.5	86.3	86.2	86.0	85.8	85.6	85.5	85.3	85.2	85.0
69	87.6	87.5	87.3	87.2	87.0	86.8	86.7	86.5	86.4	86.2	86.1	85.9	85.7	85.6	85.4	85.3
70	87.8	87.6	87.5	87.3	87.2	87.0	86.9	86.7	86.6	86.4	86.3	86.2	86.0	85.9	85.7	85.6

(3)	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0
0	65.8	65.3	64.8	64.4	63.9	63.4	63.0	62.5	62.1	61.6	61.2	60.8	60.3	59.9	59.5	59.0
1	65.8	65.3	64.8	64.4	63.9	63.4	63.0	62.5	62.1	61.6	61.2	60.8	60.3	59.9	59.5	59.1
2	65.8	65.3	64.9	64.4	63.9	63.5	63.0	62.6	62.1	61.7	61.3	60.8	60.4	60.0	59.5	59.1
3	65.9	65.4	65.0	64.5	64.0	63.6	63.1	62.7	62.2	61.8	61.4	60.9	60.5	60.1	59.6	59.2
4	66.0	65.5	65.1	64.6	64.1	63.7	63.2	62.8	62.3	61.9	61.5	61.0	60.6	60.2	59.7	59.3
5	66.1	65.6	65.2	64.7	64.2	63.8	63.3	62.9	62.4	62.0	61.6	61.1	60.7	60.3	59.8	59.4
6	66.2	65.7	65.2	64.8	64.3	63.9	63.4	63.0	62.5	62.1	61.6	61.2	60.8	60.3	59.9	59.5
7	66.2	65.8	65.3	64.9	64.4	63.9	63.5	63.0	62.6	62.2	61.7	61.3	60.9	60.4	60.0	59.6
8	66.3	65.9	65.4	64.9	64.5	64.0	63.6	63.1	62.7	62.2	61.8	61.4	61.0	60.5	60.1	59.7
9	66.4	65.9	65.5	65.0	64.6	64.1	63.7	63.2	62.8	62.3	61.9	61.5	61.1	60.6	60.2	59.8
10	66.5	66.0	65.6	65.1	64.7	64.2	63.8	63.3	62.9	62.5	62.0	61.6	61.2	60.7	60.3	59.9
11	66.6	66.1	65.7	65.2	64.8	64.3	63.9	63.4	63.0	62.6	62.1	61.7	61.3	60.9	60.4	60.0
12	66.7	66.3	65.8	65.3	64.9	64.4	64.0	63.6	63.1	62.7	62.3	61.8	61.4	61.0	60.6	60.2
13	66.8	66.4	65.9	65.5	65.0	64.6	64.1	63.7	63.2	62.8	62.4	62.0	61.5	61.1	60.7	60.3
14	67.0	66.5	66.0	65.6	65.1	64.7	64.3	63.8	63.4	63.0	62.5	62.1	61.7	61.2	60.8	60.4
15	67.1	66.6	66.2	65.7	65.3	64.8	64.4	64.0	63.5	63.1	62.7	62.2	61.8	61.4	61.0	60.6
16	67.2	66.8	66.3	65.9	65.4	65.0	64.5	64.1	63.7	63.2	62.8	62.4	62.0	61.6	61.2	60.7
17	67.4	66.9	66.5	66.0	65.6	65.1	64.7	64.3	63.8	63.4	63.0	62.6	62.1	61.7	61.3	60.9
18	67.5	67.1	66.6	66.2	65.7	65.3	64.9	64.4	64.0	63.6	63.1	62.7	62.3	61.9	61.5	61.1
19	67.7	67.2	66.8	66.3	65.9	65.5	65.0	64.6	64.2	63.7	63.3	62.9	62.5	62.1	61.7	61.3
20	67.8	67.4	66.9	66.5	66.1	65.6	65.2	64.8	64.3	63.9	63.5	63.1	62.7	62.3	61.9	61.5
21	68.0	67.5	67.1	66.7	66.2	65.8	65.4	64.9	64.5	64.1	63.7	63.3	62.9	62.5	62.1	61.7
22	68.2	67.7	67.3	66.8	66.4	66.0	65.6	65.1	64.7	64.3	63.9	63.5	63.1	62.7	62.3	61.9
23	68.3	67.9	67.5	67.0	66.6	66.2	65.8	65.3	64.9	64.5	64.1	63.7	63.3	62.9	62.5	62.1
24	68.5	68.1	67.7	67.2	66.8	66.4	66.0	65.5	65.1	64.7	64.3	63.9	63.5	63.1	62.7	62.3
25	68.7	68.3	67.9	67.4	67.0	66.6	66.2	65.8	65.3	64.9	64.5	64.1	63.7	63.3	62.9	62.5
26	68.9	68.5	68.1	67.6	67.2	66.8	66.4	66.0	65.6	65.2	64.8	64.4	64.0	63.6	63.2	62.8
27	69.1	68.7	68.3	67.9	67.4	67.0	66.6	66.2	65.8	65.4	65.0	64.6	64.2	63.8	63.4	63.0
28	69.3	68.9	68.5	68.1	67.7	67.2	66.8	66.4	66.0	65.6	65.2	64.8	64.4	64.0	63.6	63.2
29	69.5	69.1	68.7	68.3	67.9	67.5	67.1	66.7	66.3	65.9	65.5	65.1	64.7	64.3	63.9	63.5
30	69.8	69.4	68.9	68.5	68.1	67.7	67.3	66.9	66.5	66.1	65.7	65.3	64.9	64.5	64.1	63.7
31	70.0	69.6	69.2	68.8	68.4	68.0	67.6	67.2	66.8	66.4	66.0	65.6	65.2	64.8	64.4	64.0
32	70.2	69.8	69.4	69.0	68.6	68.2	67.8	67.4	67.0	66.6	66.2	65.8	65.4	65.0	64.6	64.2
33	70.5	70.1	69.7	69.3	68.9	68.5	68.1	67.7	67.3	66.9	66.5	66.1	65.7	65.3	64.9	64.5
34	70.7	70.3	69.9	69.5	69.1	68.7	68.3	67.9	67.5	67.1	66.7	66.3	65.9	65.5	65.1	64.7
35	71.0	70.6	70.2	69.8	69.4	69.0	68.6	68.2	67.8	67.4	67.0	66.6	66.2	65.8	65.4	65.0
36	71.2	70.9	70.5	70.1	69.7	69.3	68.9	68.5	68.1	67.7	67.3	66.9	66.5	66.1	65.7	65.3
37	71.5	71.1	70.7	70.3	69.9	69.5	69.1	68.7	68.3	67.9	67.5	67.1	66.7	66.3	65.9	65.5
38	71.8	71.4	71.0	70.6	70.2	69.8	69.4	69.0	68.6	68.2	67.8	67.4	67.0	66.6	66.2	65.8
39	72.1	71.7	71.3	70.9	70.5	70.1	69.7	69.3	68.9	68.5	68.1	67.7	67.3	66.9	66.5	66.1
40	72.3	72.0	71.6	71.2	70.8	70.4	70.0	69.6	69.2	68.8	68.4	68.0	67.6	67.2	66.8	66.4
41	72.6	72.3	71.9	71.5	71.1	70.7	70.3	69.9	69.5	69.1	68.7	68.3	67.9	67.5	67.1	66.7
42	72.9	72.6	72.2	71.8	71.4	71.0	70.6	70.2	69.8	69.4	69.0	68.6	68.2	67.8	67.4	67.0
43	73.2	72.9	72.5	72.1	71.7	71.3	70.9	70.5	70.1	69.7	69.3	68.9	68.5	68.1	67.7	67.3
44	73.6	73.2	72.8	72.4	72.0	71.6	71.2	70.8	70.4	70.0	69.6	69.2	68.8	68.4	68.0	67.6
45	73.9	73.5	73.1	72.7	72.3	71.9	71.5	71.1	70.7	70.3	69.9	69.5	69.1	68.7	68.3	67.9
46	74.2	73.9	73.5	73.1	72.7	72.3	71.9	71.5	71.1	70.7	70.3	69.9	69.5	69.1	68.7	68.3
47	74.5	74.2	73.9	73.5	73.1	72.7	72.3	71.9	71.5	71.1	70.7	70.3	69.9	69.5	69.1	68.7
48	74.8	74.5	74.2	73.9	73.5	73.1	72.7	72.3	71.9	71.5	71.1	70.7	70.3	69.9	69.5	69.1
49	75.2	74.9	74.6	74.2	73.9	73.5	73.1	72.7	72.3	71.9	71.5	71.1	70.7	70.3	69.9	69.5
50	75.5	75.2	74.9	74.5	74.1	73.7	73.3	72.9	72.5	72.1	71.7	71.3	70.9	70.5	70.1	69.7
51	75.9	75.6	75.3	75.0	74.7	74.4	74.1	73.8	73.5	73.2	72.9	72.6	72.3	72.0	71.7	71.4
52	76.2	75.9	75.6	75.3	75.0	74.7	74.4	74.1	73.8	73.5	73.2	72.9	72.6	72.3	72.0	71.7
53	76.6	76.3	76.0	75.7	75.4	75.1	74.8	74.5	74.2	73.9	73.6	73.3	73.0	72.7	72.4	72.1
54	77.0	76.7	76.4	76.1	75.8	75.5	75.2	74.9	74.6	74.3	74.0	73.7	73.4	73.1	72.8	72.5
55	77.3	77.0	76.7	76.4	76.1	75.8	75.5	75.2	74.9	74.6	74.3	74.0	73.7	73.4	73.1	72.8
56	77.7	77.4	77.1	76.8	76.5	76.2	75.9	75.6	75.3	75.0	74.7	74.4	74.1	73.8	73.5	73.2
57	78.1	77.8	77.5	77.2	76.9	76.6	76.3	76.0	75.7	75.4	75.1	74.8	74.5	74.2	73.9	73.6
58	78.5	78.2	77.9	77.6	77.3	77.0	76.7	76.4	76.1	75.8	75.5	75.2	74.9	74.6	74.3	74.0
59	78.8	78.5	78.2	77.9	77.6	77.3	77.0	76.7	76.4	76.1	75.8	75.5	75.2	74.9	74.6	74.3
60	79.2	79.0	78.8	78.5	78.3	78.1	77.8	77.6	77.4	77.2	77.0	76.8	76.6	76.4	76.2	76.0
61	79.6	79.4	79.2	79.0	78.7	78.5	78.3	78.1	77.8	77.6	77.4	77.2	77.0	76.8	76.6	76.4
62	80.0	79.8	79.6	79.4	79.2	79.0	78.8	78.6	78.4	78.2	78.0	77.8	77.6	77.4	77.2	77.0
63	80.4	80.2	80.0	79.8	79.6	79.4	79.2	79.0	78.8	78.6	78.4	78.2	78.0	77.8	77.6	77.4
64	80.8	80.6	80.4	80.2	80.0	79.8	79.6	79.4	79.2	79.0	78.8	78.6	78.4	78.2	78.0	77.8
65	81.3	81.1	80.9	80.7	80.5	80.3	80.1	79.9	79.7	79.5	79.3	79.1	78.9	78.7	78.5	78.3
66	81.7	81.5	81.3	81.1	80.9	80.7	80.5	80.3	80.1	79.9	79.7	79.5	79.3	79.1	78.9	78.7
67	82.1	81.9	81.7	81.5	81.3	81.1	80.9	80.7	80.5	80.3	80.1	79.9	79.7	79.5	79.3	79.1
68	82.5	82.3	82.1	81.9	81.7	81.5	81.3	81.1	80.9	80.7	80.5	80.3	80.1	79.9	79.7	79.5
69	82.9	82.7	82.5	82.3	82.1	81.9	81.7	81.5	81.3	81.1	80.9	80.7	80.5	80.3	80.1	79.9
70	83.4	83.2	83.0	82.8	82.6	82.4	82.2	82.0	81.8	81.6	81.4	81.2	81.0	80.8	80.6	80.4
71	83.8	83.6	83.4	83.2	83.0	82.8	82.6	82.4	82.2	82.0	81.8	81.6	81.4	81.2	81.0	80.8
72	84.2	84.0	83.8	83.6	83.4	83.2	83.0	82.8	82.6	82.4	82.2	82.0	81.8	81.6	81.4	81.2
73	84.6	84.4	84.2	84.0	83.8	83.6	83.4	83.2	83.0	82.8	82.6	82.4	82.2	82.0	81.8	81.6
74	85.0	84.8	84.6	84.4	84.2	84.0	83.8	83.6	83.4	83.2	83.0	82.8	82.6	82.4	82.2	82.0
75	85.4	85.2	85.0	84.8	84.6	84.4	84.2	84.0	83.8	83.6	83.4	83.2	83.0	82.8	82.6	82.4

C3

	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
0	73.3	72.8	72.3	71.7	71.2	70.7	70.2	69.7	69.2	68.7	68.2	67.7	67.2	66.7	66.3	65.8
2	73.3	72.8	72.3	71.7	71.2	70.7	70.2	69.7	69.2	68.7	68.2	67.7	67.2	66.7	66.3	65.8
4	73.3	72.8	72.3	71.8	71.3	70.8	70.2	69.7	69.2	68.7	68.2	67.8	67.3	66.8	66.3	65.8
6	73.4	72.9	72.3	71.8	71.3	70.8	70.3	69.8	69.3	68.8	68.3	67.8	67.3	66.8	66.4	65.9
8	73.5	72.9	72.4	71.9	71.4	70.9	70.4	69.9	69.4	68.9	68.4	67.9	67.4	66.9	66.5	66.0
10	73.5	73.0	72.5	72.0	71.5	71.0	70.5	70.0	69.5	69.0	68.5	68.0	67.5	67.0	66.6	66.1
11	73.6	73.1	72.6	72.1	71.5	71.0	70.5	70.0	69.5	69.1	68.6	68.1	67.6	67.1	66.8	66.2
12	73.6	73.1	72.6	72.1	71.6	71.1	70.6	70.4	69.6	69.1	68.6	68.1	67.7	67.2	66.7	66.2
13	73.7	73.2	72.7	72.2	71.7	71.2	70.7	70.2	69.7	69.2	68.7	68.2	67.7	67.3	66.8	66.3
14	73.8	73.3	72.8	72.2	71.7	71.2	70.7	70.3	69.8	69.3	68.8	68.3	67.8	67.4	66.9	66.4
15	73.8	73.3	72.8	72.3	71.8	71.3	70.8	70.3	69.8	69.4	68.9	68.4	67.9	67.4	67.0	66.5
16	73.9	73.4	72.9	72.4	71.9	71.4	70.9	70.4	69.9	69.4	69.0	68.5	68.0	67.5	67.1	66.6
17	74.0	73.5	73.0	72.5	72.0	71.5	71.0	70.5	70.0	69.5	69.1	68.6	68.1	67.6	67.2	66.7
18	74.1	73.6	73.1	72.6	72.1	71.6	71.1	70.6	70.1	69.6	69.2	68.7	68.2	67.8	67.3	66.8
19	74.2	73.7	73.2	72.7	72.2	71.7	71.2	70.7	70.2	69.8	69.3	68.8	68.3	67.9	67.4	67.0
20	74.3	73.8	73.3	72.8	72.3	71.8	71.3	70.8	70.3	69.9	69.4	68.9	68.5	68.0	67.5	67.1
21	74.4	73.9	73.4	72.9	72.4	71.9	71.4	70.9	70.5	70.0	69.5	69.1	68.6	68.1	67.6	67.2
22	74.5	74.0	73.5	73.0	72.5	72.0	71.5	71.1	70.6	70.1	69.7	69.2	68.7	68.3	67.8	67.4
23	74.6	74.1	73.6	73.1	72.6	72.1	71.7	71.2	70.7	70.3	69.8	69.3	68.9	68.4	68.0	67.5
24	74.7	74.2	73.7	73.2	72.7	72.3	71.8	71.3	70.9	70.4	69.9	69.5	69.0	68.6	68.1	67.7
25	74.8	74.3	73.8	73.3	72.9	72.4	71.9	71.5	71.0	70.5	70.1	69.6	69.2	68.7	68.3	67.8
26	74.9	74.4	74.0	73.5	73.0	72.5	72.1	71.6	71.1	70.7	70.2	69.8	69.3	68.9	68.4	68.0
27	75.0	74.6	74.1	73.6	73.1	72.7	72.2	71.8	71.3	70.8	70.4	69.9	69.5	69.0	68.6	68.2
28	75.2	74.7	74.2	73.8	73.3	72.8	72.4	71.9	71.5	71.0	70.5	70.1	69.7	69.2	68.8	68.3
29	75.3	74.8	74.4	73.9	73.4	73.0	72.5	72.1	71.6	71.2	70.7	70.3	69.8	69.4	69.0	68.5
30	75.4	75.0	74.5	74.1	73.6	73.1	72.7	72.2	71.8	71.3	70.9	70.5	70.0	69.6	69.1	68.7
31	75.6	75.1	74.7	74.2	73.8	73.3	72.9	72.4	72.0	71.5	71.1	70.6	70.2	69.8	69.3	68.9
32	75.7	75.3	74.8	74.4	73.9	73.5	73.0	72.6	72.1	71.7	71.3	70.8	70.4	70.0	69.5	69.1
33	75.9	75.4	75.0	74.5	74.1	73.6	73.2	72.8	72.3	71.9	71.5	71.0	70.6	70.2	69.7	69.3
34	76.0	75.6	75.1	74.7	74.3	73.8	73.4	72.9	72.5	72.1	71.7	71.2	70.8	70.4	70.0	69.5
35	76.2	75.8	75.3	74.9	74.4	74.0	73.6	73.1	72.7	72.3	71.9	71.4	71.0	70.6	70.2	69.8
36	76.4	75.9	75.5	75.1	74.6	74.2	73.8	73.3	72.9	72.5	72.1	71.6	71.2	70.8	70.4	70.0
37	76.5	76.1	75.7	75.2	74.8	74.4	74.0	73.5	73.1	72.7	72.3	71.9	71.5	71.0	70.6	70.2
38	76.7	76.3	75.8	75.4	75.0	74.6	74.2	73.7	73.3	72.9	72.5	72.1	71.7	71.3	70.9	70.5
39	76.9	76.5	76.0	75.6	75.2	74.8	74.4	74.0	73.5	73.1	72.7	72.3	71.9	71.5	71.1	70.7
40	77.1	76.6	76.2	75.8	75.4	75.0	74.6	74.2	73.8	73.4	73.0	72.6	72.2	71.8	71.4	71.0
41	77.2	76.8	76.4	76.0	75.6	75.2	74.8	74.4	74.0	73.6	73.2	72.8	72.4	72.0	71.6	71.2
42	77.4	77.0	76.6	76.2	75.8	75.4	75.0	74.6	74.2	73.8	73.4	73.1	72.7	72.3	71.9	71.5
43	77.6	77.2	76.8	76.4	76.0	75.6	75.2	74.9	74.5	74.1	73.7	73.3	72.9	72.5	72.2	71.8
44	77.8	77.4	77.0	76.6	76.3	75.9	75.5	75.1	74.7	74.3	73.9	73.6	73.2	72.8	72.4	72.1
45	78.0	77.6	77.3	76.9	76.5	76.1	75.7	75.3	75.0	74.6	74.2	73.8	73.5	73.1	72.7	72.3
46	78.2	77.8	77.5	77.1	76.7	76.3	76.0	75.6	75.2	74.8	74.5	74.1	73.7	73.4	73.0	72.6
47	78.4	78.1	77.7	77.3	76.9	76.6	76.2	75.8	75.5	75.1	74.7	74.4	74.0	73.7	73.3	72.9
48	78.6	78.3	77.9	77.5	77.2	76.8	76.5	76.1	75.7	75.4	75.0	74.7	74.3	73.9	73.6	73.2
49	78.9	78.5	78.1	77.8	77.4	77.1	76.7	76.4	76.0	75.6	75.3	74.9	74.6	74.2	73.9	73.6
50	79.1	78.7	78.4	78.0	77.7	77.3	77.0	76.6	76.3	75.9	75.6	75.2	74.9	74.5	74.2	73.9
51	79.3	79.0	78.6	78.3	77.9	77.6	77.2	76.9	76.6	76.2	75.9	75.5	75.2	74.9	74.5	74.2
52	79.5	79.2	78.9	78.5	78.2	77.8	77.5	77.2	76.8	76.5	76.2	75.8	75.5	75.2	74.8	74.5
53	79.8	79.4	79.1	78.8	78.4	78.1	77.8	77.4	77.1	76.8	76.5	76.1	75.8	75.5	75.2	74.8
54	80.0	79.7	79.3	79.0	78.7	78.4	78.1	77.7	77.4	77.1	76.8	76.5	76.1	75.8	75.5	75.2
55	80.2	79.9	79.6	79.3	79.0	78.6	78.3	78.0	77.7	77.4	77.1	76.8	76.5	76.1	75.8	75.5
56	80.5	80.2	79.9	79.5	79.2	78.9	78.6	78.3	78.0	77.7	77.4	77.1	76.8	76.5	76.2	75.9
57	80.7	80.4	80.1	79.8	79.5	79.2	78.9	78.6	78.3	78.0	77.7	77.4	77.1	76.8	76.5	76.2
58	81.0	80.7	80.4	80.1	79.8	79.5	79.2	78.9	78.6	78.3	78.0	77.7	77.5	77.2	76.9	76.6
59	81.2	80.9	80.6	80.4	80.1	79.8	79.5	79.2	78.9	78.6	78.4	78.1	77.8	77.5	77.2	77.0
60	81.5	81.2	80.9	80.6	80.4	80.1	79.8	79.5	79.2	79.0	78.7	78.4	78.1	77.9	77.6	77.3
61	81.7	81.5	81.2	80.9	80.6	80.4	80.1	79.8	79.6	79.3	79.0	78.8	78.5	78.2	78.0	77.7
62	82.0	81.7	81.5	81.2	80.9	80.7	80.4	80.1	79.9	79.6	79.4	79.1	78.8	78.6	78.3	78.1
63	82.2	82.0	81.7	81.5	81.2	81.0	80.7	80.5	80.2	80.0	79.7	79.5	79.2	79.0	78.7	78.5
64	82.5	82.3	82.0	81.8	81.5	81.3	81.0	80.8	80.5	80.3	80.1	79.8	79.6	79.3	79.1	78.8
65	82.8	82.5	82.3	82.1	81.8	81.6	81.3	81.1	80.9	80.6	80.4	80.2	79.9	79.7	79.5	79.2
66	83.0	82.8	82.6	82.4	82.1	81.9	81.7	81.4	81.2	81.0	80.8	80.5	80.3	80.1	79.9	79.6
67	83.3	83.1	82.9	82.7	82.4	82.2	82.0	81.8	81.6	81.3	81.1	80.9	80.7	80.5	80.2	80.0
68	83.6	83.4	83.2	83.0	82.7	82.5	82.3	82.1	81.9	81.7	81.5	81.3	81.1	80.8	80.6	80.4
69	83.9	83.7	83.5	83.3	83.1	82.9	82.7	82.5	82.3	82.0	81.8	81.6	81.4	81.2	81.0	80.8
70	84.1	83.9	83.7	83.6	83.4	83.2	83.0	82.8	82.6	82.4	82.2	82.0	81.8	81.6	81.4	81.3
71	84.4	84.2	84.0	83.9	83.7	83.5	83.3	83.1	83.0	82.8	82.6	82.4	82.2	82.0	81.9	81.7
72	84.7	84.5	84.4	84.2	84.0	83.8	83.7	83.5	83.3	83.1	83.0	82.8	82.6	82.4	82.3	82.1
73	85.0	84.8	84.7	84.5	84.3	84.2	84.0	83.8	83.7	83.5	83.3	83.2	83.0	82.8	82.7	82.5
74	85.3	85.1	85.0	84.8	84.6	84.5	84.3	84.2	84.0	83.9	83.7	83.6	83.4	83.2	83.1	82.9
75	85.6	85.4	85.3	85.1	85.0	84.8	84.7	84.5	84.4	84.2	84.1	83.9	83.8	83.7	83.5	83.4

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	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7.0	7.1	7.2	7.3	7.4	7.5
0	59.0	58.6	58.2	57.8	57.4	57.0	56.6	56.2	55.8	55.4	55.0	54.6	54.2	53.9	53.5	53.1
1	59.1	58.5	58.2	57.8	57.4	57.0	56.6	56.2	55.8	55.4	55.0	54.6	54.3	53.9	53.5	53.1
2	59.1	58.7	58.3	57.9	57.5	57.1	56.7	56.3	55.9	55.5	55.1	54.7	54.3	54.0	53.6	53.2
3	59.2	58.8	58.4	58.0	57.6	57.2	56.8	56.4	56.0	55.6	55.2	54.8	54.4	54.1	53.7	53.3
4	59.3	58.9	58.5	58.1	57.7	57.3	56.9	56.5	56.1	55.7	55.3	54.9	54.5	54.2	53.8	53.4
5	59.4	59.0	58.6	58.2	57.8	57.4	57.0	56.6	56.2	55.8	55.4	55.0	54.6	54.3	53.9	53.5
6	59.5	59.1	58.7	58.3	57.9	57.5	57.1	56.7	56.3	55.9	55.5	55.1	54.7	54.4	54.0	53.6
7	59.6	59.2	58.8	58.4	58.0	57.6	57.2	56.8	56.4	56.0	55.6	55.2	54.8	54.5	54.1	53.7
8	59.7	59.3	58.9	58.5	58.1	57.7	57.3	56.9	56.5	56.1	55.6	55.3	54.9	54.6	54.2	53.8
9	59.8	59.4	59.0	58.6	58.2	57.8	57.4	57.0	56.6	56.2	55.8	55.4	55.1	54.7	54.3	54.0
10	59.9	59.5	59.1	58.7	58.3	57.9	57.5	57.1	56.7	56.3	55.9	55.6	55.2	54.8	54.4	54.1
11	60.0	59.6	59.2	58.8	58.4	58.0	57.6	57.2	56.8	56.4	56.1	55.7	55.3	54.9	54.6	54.2
12	60.2	59.7	59.3	58.9	58.5	58.1	57.7	57.4	57.0	56.6	56.2	55.8	55.5	55.1	54.7	54.4
13	60.3	59.9	59.5	59.1	58.7	58.3	57.9	57.5	57.1	56.7	56.3	56.0	55.6	55.2	54.9	54.5
14	60.4	60.0	59.6	59.2	58.8	58.4	58.0	57.6	57.3	56.9	56.5	56.1	55.8	55.4	55.0	54.7
15	60.6	60.2	59.8	59.4	59.0	58.6	58.2	57.8	57.4	57.0	56.7	56.3	55.9	55.6	55.2	54.8
16	60.7	60.3	59.9	59.5	59.1	58.7	58.4	58.0	57.6	57.2	56.8	56.5	56.1	55.7	55.4	55.0
17	60.9	60.5	60.1	59.7	59.3	58.9	58.5	58.2	57.8	57.4	57.0	56.6	56.3	55.9	55.5	55.2
18	61.1	60.7	60.3	59.9	59.5	59.1	58.7	58.3	58.0	57.6	57.2	56.8	56.5	56.1	55.7	55.4
19	61.3	60.9	60.5	60.1	59.7	59.3	58.9	58.5	58.2	57.8	57.4	57.0	56.7	56.3	55.9	55.6
20	61.5	61.1	60.7	60.3	59.9	59.5	59.1	58.7	58.4	58.0	57.6	57.2	56.9	56.5	56.2	55.8
21	61.7	61.3	60.9	60.5	60.1	59.7	59.3	58.9	58.6	58.2	57.8	57.5	57.1	56.7	56.4	56.0
22	61.9	61.5	61.1	60.7	60.3	59.9	59.5	59.2	58.8	58.4	58.0	57.7	57.3	57.0	56.6	56.2
23	62.1	61.7	61.3	60.9	60.5	60.1	59.8	59.4	59.0	58.6	58.3	57.9	57.6	57.2	56.8	56.5
24	62.3	61.9	61.5	61.1	60.8	60.4	60.0	59.6	59.3	58.9	58.5	58.2	57.8	57.4	57.1	56.7
25	62.5	62.2	61.8	61.4	61.0	60.6	60.2	59.9	59.5	59.1	58.8	58.4	58.1	57.7	57.3	57.0
26	62.8	62.4	62.0	61.6	61.3	60.9	60.5	60.1	59.8	59.4	59.0	58.7	58.3	58.0	57.6	57.3
27	63.0	62.6	62.3	61.9	61.5	61.1	60.8	60.4	60.0	59.7	59.3	58.9	58.6	58.2	57.9	57.5
28	63.3	62.9	62.5	62.1	61.8	61.4	61.0	60.7	60.3	59.9	59.6	59.2	58.9	58.5	58.2	57.8
29	63.6	63.2	62.8	62.4	62.1	61.7	61.3	60.9	60.6	60.2	59.9	59.5	59.2	58.8	58.5	58.1
30	63.8	63.4	63.1	62.7	62.3	62.0	61.6	61.2	60.9	60.5	60.2	59.8	59.5	59.1	58.8	58.4
31	64.1	63.7	63.4	63.0	62.6	62.3	61.9	61.5	61.2	60.8	60.5	60.1	59.8	59.4	59.1	58.8
32	64.4	64.0	63.7	63.3	62.9	62.6	62.2	61.8	61.5	61.1	60.8	60.4	60.1	59.8	59.4	59.1
33	64.7	64.3	64.0	63.6	63.2	62.9	62.5	62.2	61.8	61.5	61.1	60.8	60.4	60.1	59.8	59.4
34	65.0	64.6	64.3	63.9	63.6	63.2	62.8	62.5	62.1	61.8	61.5	61.1	60.8	60.4	60.1	59.8
35	65.3	65.0	64.6	64.2	63.9	63.5	63.2	62.8	62.5	62.1	61.8	61.5	61.1	60.8	60.5	60.1
36	65.6	65.3	64.9	64.6	64.2	63.9	63.5	63.2	62.8	62.5	62.2	61.8	61.5	61.1	60.8	60.5
37	66.0	65.6	65.3	64.9	64.6	64.2	63.9	63.5	63.2	62.9	62.5	62.2	61.9	61.5	61.2	60.9
38	66.3	66.0	65.6	65.3	64.9	64.6	64.2	63.9	63.6	63.2	62.9	62.6	62.2	61.9	61.6	61.3
39	66.7	66.3	66.0	65.6	65.3	64.9	64.6	64.3	63.9	63.6	63.3	62.9	62.6	62.3	62.0	61.7
40	67.0	66.7	66.3	66.0	65.7	65.3	65.0	64.7	64.3	64.0	63.7	63.3	63.0	62.7	62.4	62.1
41	67.4	67.0	66.7	66.4	66.0	65.7	65.4	65.0	64.7	64.4	64.1	63.7	63.4	63.1	62.8	62.5
42	67.7	67.4	67.1	66.7	66.4	66.1	65.8	65.4	65.1	64.8	64.5	64.2	63.8	63.5	63.2	62.9
43	68.1	67.8	67.5	67.1	66.8	66.5	66.2	65.9	65.5	65.2	64.9	64.6	64.3	64.0	63.7	63.4
44	68.5	68.2	67.9	67.5	67.2	66.9	66.6	66.3	66.0	65.6	65.3	65.0	64.7	64.4	64.1	63.8
45	68.9	68.6	68.3	68.0	67.6	67.3	67.0	66.7	66.4	66.1	65.8	65.5	65.2	64.9	64.6	64.3
46	69.3	69.0	68.7	68.4	68.1	67.8	67.4	67.1	66.8	66.5	66.2	65.9	65.6	65.3	65.0	64.7
47	69.7	69.4	69.1	68.8	68.5	68.2	67.9	67.6	67.3	67.0	66.7	66.4	66.1	65.8	65.5	65.2
48	70.1	69.8	69.5	69.2	68.9	68.6	68.3	68.0	67.7	67.4	67.2	66.9	66.6	66.3	66.0	65.7
49	70.6	70.3	70.0	69.7	69.4	69.1	68.8	68.5	68.2	67.9	67.6	67.3	67.1	66.8	66.5	66.2
50	71.0	70.7	70.4	70.1	69.8	69.6	69.3	69.0	68.7	68.4	68.1	67.8	67.6	67.3	67.0	66.7
51	71.5	71.2	70.9	70.6	70.3	70.0	69.7	69.5	69.2	68.9	68.6	68.3	68.1	67.8	67.5	67.2
52	71.9	71.6	71.3	71.1	70.8	70.5	70.2	70.0	69.7	69.4	69.1	68.9	68.6	68.3	68.0	67.8
53	72.4	72.1	71.8	71.5	71.3	71.0	70.7	70.5	70.2	69.9	69.6	69.4	69.1	68.9	68.6	68.3
54	72.8	72.6	72.3	72.0	71.8	71.5	71.2	71.0	70.7	70.4	70.2	69.9	69.7	69.4	69.1	68.9
55	73.3	73.0	72.8	72.5	72.3	72.0	71.7	71.5	71.2	71.0	70.7	70.5	70.2	69.9	69.7	69.4
56	73.8	73.5	73.3	73.0	72.8	72.5	72.3	72.0	71.8	71.5	71.3	71.0	70.8	70.5	70.3	70.0
57	74.3	74.0	73.8	73.5	73.3	73.0	72.8	72.5	72.3	72.1	71.8	71.6	71.3	71.1	70.8	70.6
58	74.8	74.5	74.3	74.0	73.8	73.6	73.3	73.1	72.8	72.6	72.4	72.1	71.9	71.7	71.4	71.2
59	75.3	75.0	74.8	74.6	74.3	74.1	73.9	73.6	73.4	73.2	72.9	72.7	72.5	72.3	72.0	71.8
60	75.8	75.5	75.3	75.1	74.9	74.6	74.4	74.2	74.0	73.7	73.5	73.3	73.1	72.9	72.6	72.4
61	76.3	76.1	75.8	75.6	75.4	75.2	75.0	74.8	74.5	74.3	74.1	73.9	73.7	73.5	73.2	73.0
62	76.8	76.6	76.4	76.2	76.0	75.3	75.5	75.3	75.1	74.9	74.7	74.5	74.3	74.1	73.9	73.7
63	77.3	77.6	76.9	76.7	76.5	76.3	76.1	75.9	75.7	75.5	75.3	75.1	74.9	74.7	74.5	74.3
64	77.9	77.7	77.5	77.3	77.1	76.9	76.7	76.5	76.3	76.1	75.9	75.7	75.5	75.4	75.2	75.0
65	78.4	78.2	78.0	77.9	77.7	77.5	77.3	77.1	76.9	76.7	76.5	76.4	76.2	76.0	75.8	75.6
66	79.0	78.8	78.6	78.4	78.2	78.1	77.9	77.7	77.5	77.4	77.2	77.0	76.8	76.7	76.5	76.3
67	79.5	79.4	79.2	79.0	78.8	78.7	78.5	78.3	78.1	78.0	77.8	77.7	77.5	77.3	77.1	77.0
68	80.1	79.9	79.7	79.6	79.4	79.3	79.1	79.0	78.8	78.6	78.4	78.3	78.1	78.0	77.8	77.7
69	80.6	80.5	80.3	80.2	80.0	79.9	79.7	79.6	79.4	79.2	79.1	79.0	78.8	78.7	78.5	78.4
70	81.2	81.1	80.9	80.8	80.6	80.5	80.3	80.2	80.0	79.9	79.7	79.6	79.4	79.3	79.2	79.1

③	7.5	7.6	7.7	7.8	7.9	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	9.0	C
0	53.1	52.8	52.4	52.0	51.7	51.3	51.0	50.6	50.3	50.0	49.6	49.3	49.0	48.7	48.3	48.0	
2	53.1	52.8	52.4	52.1	51.7	51.4	51.0	50.7	50.3	50.0	49.7	49.3	49.0	48.7	48.3	48.0	
4	53.2	52.9	52.5	52.1	51.8	51.4	51.1	50.7	50.4	50.1	49.7	49.4	49.1	48.8	48.4	48.1	
6	53.3	53.0	52.6	52.2	51.9	51.5	51.2	50.8	50.5	50.2	49.8	49.5	49.2	48.9	48.5	48.2	
8	53.4	53.1	52.7	52.3	52.0	51.6	51.3	50.9	50.6	50.3	49.9	49.6	49.3	49.0	48.6	48.3	
10	53.5	53.2	52.8	52.5	52.1	51.8	51.4	51.1	50.7	50.4	50.1	49.7	49.4	49.1	48.8	48.4	
11	53.6	53.3	52.9	52.6	52.2	51.9	51.5	51.2	50.8	50.5	50.2	49.8	49.5	49.2	48.9	48.5	
12	53.7	53.4	53.0	52.7	52.3	52.0	51.6	51.3	50.9	50.6	50.3	49.9	49.6	49.3	49.0	48.6	
13	53.8	53.5	53.1	52.8	52.4	52.1	51.7	51.4	51.0	50.7	50.4	50.0	49.7	49.4	49.1	48.8	
14	54.0	53.6	53.2	52.9	52.5	52.2	51.8	51.5	51.2	50.8	50.5	50.2	49.8	49.5	49.2	48.9	
15	54.1	53.7	53.4	53.0	52.7	52.3	52.0	51.6	51.3	50.9	50.6	50.3	50.0	49.6	49.3	49.0	
16	54.2	53.8	53.5	53.1	52.8	52.4	52.1	51.8	51.4	51.1	50.7	50.4	50.1	49.8	49.5	49.1	
17	54.4	54.0	53.6	53.3	52.9	52.6	52.2	51.9	51.6	51.2	50.9	50.6	50.2	49.9	49.6	49.3	
18	54.5	54.1	53.8	53.4	53.1	52.7	52.4	52.1	51.7	51.4	51.0	50.7	50.4	50.1	49.8	49.4	
19	54.7	54.3	53.9	53.6	53.2	52.9	52.6	52.2	51.9	51.5	51.2	50.9	50.6	50.2	49.9	49.6	
20	54.8	54.5	54.1	53.8	53.4	53.1	52.7	52.4	52.0	51.7	51.4	51.1	50.7	50.4	50.1	49.8	
21	55.0	54.6	54.3	53.9	53.6	53.2	52.9	52.6	52.2	51.9	51.6	51.2	50.9	50.6	50.3	50.0	
22	55.2	54.8	54.5	54.1	53.8	53.4	53.1	52.8	52.4	52.1	51.8	51.4	51.1	50.8	50.5	50.2	
23	55.4	55.0	54.7	54.3	54.0	53.6	53.3	53.0	52.6	52.3	52.0	51.6	51.3	51.0	50.7	50.4	
24	55.6	55.2	54.9	54.5	54.2	53.8	53.5	53.2	52.8	52.5	52.2	51.8	51.5	51.2	50.9	50.6	
25	55.8	55.4	55.1	54.7	54.4	54.1	53.7	53.4	53.0	52.7	52.4	52.1	51.7	51.4	51.1	50.8	
26	56.0	55.7	55.3	55.0	54.6	54.3	53.9	53.6	53.3	52.9	52.6	52.3	52.0	51.7	51.3	51.0	
27	56.2	55.9	55.5	55.2	54.9	54.5	54.2	53.8	53.5	53.2	52.9	52.5	52.2	51.9	51.6	51.3	
28	56.5	56.1	55.8	55.4	55.1	54.8	54.4	54.1	53.8	53.4	53.1	52.8	52.5	52.2	51.8	51.5	
29	56.7	56.4	56.0	55.7	55.4	55.0	54.7	54.4	54.0	53.7	53.4	53.1	52.7	52.4	52.1	51.8	
30	57.0	56.6	56.3	56.0	55.6	55.3	55.0	54.6	54.3	54.0	53.6	53.3	53.0	52.7	52.4	52.1	
31	57.3	56.9	56.6	56.2	55.9	55.6	55.2	54.9	54.6	54.2	53.9	53.6	53.3	53.0	52.7	52.4	
32	57.5	57.2	56.9	56.5	56.2	55.8	55.5	55.2	54.9	54.5	54.2	53.9	53.6	53.3	53.0	52.7	
33	57.8	57.5	57.1	56.8	56.5	56.1	55.8	55.5	55.2	54.8	54.5	54.2	53.9	53.6	53.3	53.0	
34	58.1	57.8	57.4	57.1	56.8	56.4	56.1	55.8	55.5	55.1	54.8	54.5	54.2	53.9	53.6	53.3	
35	58.4	58.1	57.8	57.4	57.1	56.8	56.4	56.1	55.8	55.5	55.2	54.8	54.5	54.2	53.9	53.6	
36	58.8	58.4	58.1	57.7	57.4	57.1	56.8	56.4	56.1	55.8	55.5	55.2	54.9	54.6	54.3	54.0	
37	59.1	58.7	58.4	58.1	57.8	57.4	57.1	56.8	56.5	56.1	55.8	55.5	55.2	54.9	54.6	54.3	
38	59.4	59.1	58.8	58.4	58.1	57.8	57.4	57.1	56.8	56.5	56.2	55.9	55.6	55.3	55.0	54.7	
39	59.8	59.4	59.1	58.8	58.5	58.1	57.8	57.5	57.2	56.9	56.6	56.2	55.9	55.6	55.3	55.0	
40	60.1	59.8	59.5	59.1	58.8	58.5	58.2	57.9	57.6	57.2	56.9	56.6	56.3	56.0	55.7	55.4	
41	60.5	60.2	59.8	59.5	59.2	58.9	58.6	58.2	57.9	57.6	57.3	57.0	56.7	56.4	56.1	55.8	
42	60.9	60.5	60.2	59.9	59.6	59.3	59.0	58.6	58.3	58.0	57.7	57.4	57.1	56.8	56.5	56.2	
43	61.3	60.9	60.6	60.3	60.0	59.7	59.4	59.0	58.7	58.4	58.1	57.8	57.5	57.2	56.9	56.6	
44	61.7	61.3	61.0	60.7	60.4	60.1	59.8	59.5	59.2	58.9	58.6	58.3	58.0	57.7	57.4	57.1	
45	62.1	61.7	61.4	61.1	60.8	60.5	60.2	59.9	59.6	59.3	59.0	58.7	58.4	58.1	57.8	57.5	
46	62.5	62.2	61.9	61.5	61.2	60.9	60.6	60.3	60.0	59.7	59.4	59.1	58.9	58.6	58.3	58.0	
47	62.9	62.6	62.3	62.0	61.7	61.4	61.1	60.8	60.5	60.2	59.9	59.6	59.3	59.0	58.7	58.5	
48	63.4	63.0	62.7	62.4	62.1	61.8	61.5	61.2	61.0	60.7	60.4	60.1	59.8	59.5	59.2	58.9	
49	63.8	63.5	63.2	62.9	62.6	62.3	62.0	61.7	61.4	61.1	60.9	60.6	60.3	60.0	59.7	59.4	
50	64.3	64.0	63.7	63.4	63.1	62.8	62.5	62.2	61.9	61.6	61.4	61.1	60.8	60.5	60.2	60.0	
51	64.7	64.4	64.1	63.9	63.6	63.3	63.0	62.7	62.4	62.1	61.9	61.6	61.3	61.0	60.7	60.5	
52	65.2	64.9	64.6	64.4	64.1	63.8	63.5	63.2	62.9	62.7	62.4	62.1	61.8	61.6	61.3	61.0	
53	65.7	65.4	65.1	64.9	64.6	64.3	64.0	63.7	63.5	63.2	62.9	62.6	62.4	62.1	61.8	61.6	
54	66.2	65.9	65.6	65.4	65.1	64.8	64.5	64.3	64.0	63.7	63.5	63.2	62.9	62.6	62.4	62.1	
55	66.7	66.4	66.2	65.9	65.6	65.4	65.1	64.8	64.5	64.3	64.0	63.7	63.5	63.2	63.0	62.7	
56	67.2	67.0	66.7	66.4	66.2	65.9	65.6	65.4	65.1	64.9	64.6	64.3	64.1	63.8	63.5	63.3	
57	67.8	67.5	67.2	67.0	66.7	66.5	66.2	65.9	65.7	65.4	65.2	64.9	64.6	64.4	64.1	63.9	
58	68.3	68.1	67.8	67.5	67.3	67.0	66.8	66.5	66.3	66.0	65.8	65.5	65.2	65.0	64.8	64.5	
59	68.9	68.6	68.4	68.1	67.9	67.6	67.4	67.1	66.9	66.6	66.4	66.1	65.9	65.6	65.4	65.1	
60	69.4	69.2	68.9	68.7	68.4	68.2	68.0	67.7	67.5	67.2	67.0	66.7	66.5	66.3	66.0	65.8	
61	70.0	69.8	69.5	69.3	69.0	68.8	68.6	68.3	68.1	67.8	67.6	67.4	67.1	66.9	66.7	66.4	
62	70.6	70.4	70.1	69.9	69.7	69.4	69.2	68.9	68.7	68.5	68.2	68.0	67.8	67.6	67.3	67.1	
63	71.2	71.0	70.7	70.5	70.3	70.0	69.8	69.6	69.4	69.1	68.9	68.7	68.4	68.2	68.0	67.8	
64	71.8	71.6	71.3	71.1	70.9	70.7	70.5	70.2	70.0	69.8	69.6	69.3	69.1	68.9	68.7	68.5	
65	72.4	72.2	72.0	71.8	71.5	71.3	71.1	70.9	70.7	70.5	70.2	70.0	69.8	69.6	69.4	69.2	
66	73.0	72.8	72.6	72.4	72.2	72.0	71.8	71.6	71.4	71.1	70.9	70.7	70.5	70.3	70.1	69.9	
67	73.7	73.5	73.3	73.1	72.9	72.6	72.4	72.2	72.0	71.8	71.6	71.4	71.2	71.0	70.8	70.6	
68	74.3	74.1	73.9	73.7	73.5	73.3	73.1	72.9	72.7	72.5	72.3	72.1	72.0	71.8	71.6	71.4	
69	75.0	74.8	74.6	74.4	74.2	74.0	73.8	73.6	73.5	73.3	73.1	72.9	72.7	72.5	72.3	72.1	
70	75.6	75.4	75.3	75.1	74.9	74.7	74.5	74.3	74.1	74.0	73.8	73.6	73.5	73.3	73.1	72.9	
71	76.3	76.1	76.0	75.8	75.6	75.4	75.3	75.1	74.9	74.7	74.6	74.4	74.2	74.0	73.9	73.7	
72	77.0	76.8	76.7	76.5	76.3	76.1	76.0	75.8	75.7	75.5	75.3	75.1	75.0	74.8	74.7	74.5	
73	77.7	77.5	77.9	77.2	77.0	76.8	76.7	76.5	76.4	76.2	76.1	75.9	75.8	75.6	75.5	75.3	
74	78.4	78.2	78.1	77.9	77.8	77.6	77.7	77.3	77.1	77.0	76.9	76.7	76.6	76.4	76.3	76.1	

3

Г.П.: 10-ТОНА ТОНА КТОУ. ТОНА Г.М.: КТОУ ГР-КТОУ

	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	10.0	10.2	10.4	10.6	10.8	11.0
0	46.0	47.7	47.4	47.1	46.8	46.5	46.2	45.9	45.6	45.3	45.0	44.4	43.9	43.5	42.8	42.3
2	46.6	47.7	47.4	47.1	46.8	46.5	46.2	45.9	45.6	45.3	45.0	44.4	43.9	43.4	42.8	42.3
4	46.1	47.0	47.5	47.3	46.9	46.6	46.3	46.0	45.7	45.4	45.1	44.5	44.0	43.4	42.8	42.4
6	46.2	47.9	47.6	47.3	47.0	46.7	46.4	46.1	45.8	45.5	45.2	44.6	44.1	43.5	43.0	42.5
8	46.3	48.0	47.7	47.4	47.1	46.8	46.5	46.2	45.9	45.6	45.3	44.7	44.3	43.6	43.1	42.6
10	46.4	48.1	47.0	47.3	47.2	46.9	46.6	46.3	46.0	45.7	45.4	44.9	44.3	43.8	43.3	42.7
11	46.5	48.2	47.9	47.6	47.3	47.0	46.7	46.4	46.1	45.8	45.5	45.0	44.4	43.9	43.3	42.8
12	46.6	48.3	48.0	47.7	47.4	47.1	46.8	46.5	46.2	45.9	45.6	45.1	44.5	44.0	43.4	42.9
13	46.8	48.4	48.1	47.8	47.5	47.2	46.9	46.6	46.3	46.0	45.7	45.2	44.6	44.1	43.5	43.0
14	46.9	48.6	48.2	47.9	47.6	47.3	47.0	46.7	46.4	46.2	45.8	45.3	44.7	44.2	43.4	43.1
16	49.0	48.7	48.4	48.1	47.8	47.5	47.2	46.9	46.6	46.8	46.0	45.4	44.0	44.3	43.8	43.2
16	49.1	48.8	48.5	48.2	47.9	47.6	47.3	47.0	46.7	46.4	46.1	45.6	45.0	44.5	43.9	43.4
17	49.3	49.0	48.7	48.4	48.0	47.7	47.4	47.2	46.9	46.6	46.3	45.7	45.2	44.6	44.1	43.6
18	49.4	49.1	48.8	48.5	48.3	47.9	47.6	47.3	47.0	46.7	46.4	45.9	45.3	44.8	44.2	43.7
19	49.6	49.3	49.0	48.7	48.4	48.1	47.8	47.5	47.2	46.9	46.6	46.0	45.5	44.9	44.4	43.9
20	49.8	49.5	49.2	48.9	48.5	48.2	47.9	47.7	47.4	47.1	46.8	46.3	45.7	45.1	44.6	44.1
21	50.0	49.7	49.4	49.0	48.7	48.4	48.1	47.8	47.5	47.3	47.0	46.4	45.9	45.3	44.8	44.3
22	50.2	49.8	49.5	49.3	48.9	48.6	48.3	48.0	47.7	47.5	47.3	46.6	46.0	45.5	45.0	44.5
23	50.4	50.0	49.7	49.4	49.1	48.8	48.5	48.3	47.9	47.7	47.4	46.6	46.3	45.7	45.2	44.7
24	50.6	50.3	50.0	49.6	49.3	49.0	48.7	48.5	48.3	47.9	47.4	47.0	46.5	45.9	45.4	44.9
26	50.8	50.5	50.3	49.9	49.6	49.3	49.0	48.7	48.4	48.1	47.8	47.2	46.7	46.1	45.6	45.1
26	51.0	50.7	50.4	50.1	49.8	49.5	49.2	48.9	48.6	48.3	48.1	47.5	46.9	46.4	45.9	45.4
27	51.3	51.0	50.7	50.4	50.1	49.8	49.5	49.3	48.9	48.6	48.3	47.7	47.2	46.6	46.1	45.6
28	51.5	51.3	50.9	50.6	50.3	50.0	49.7	49.4	49.1	48.8	48.6	48.0	47.4	46.8	46.4	45.8
29	51.8	51.5	51.2	50.9	50.6	50.3	50.0	49.7	49.4	49.1	48.8	48.3	47.7	47.2	46.6	46.1
30	52.1	51.8	51.5	51.2	50.9	50.6	50.3	50.0	49.7	49.4	49.1	48.5	48.0	47.4	46.9	46.4
31	52.4	52.0	51.7	51.4	51.1	50.8	50.5	50.3	50.0	49.7	49.4	48.8	48.3	47.7	47.2	46.7
32	52.7	52.3	52.0	51.7	51.4	51.1	50.9	50.6	50.3	50.0	49.7	49.1	48.6	48.0	47.5	47.0
33	53.0	52.4	52.3	52.0	51.7	51.5	51.2	50.9	50.6	50.3	50.0	49.5	48.9	48.4	47.8	47.3
34	53.3	53.0	52.7	52.4	52.1	51.8	51.5	51.3	50.9	50.6	50.3	49.8	49.3	48.7	48.2	47.6
36	53.8	53.3	53.0	52.7	52.4	52.1	51.8	51.5	51.2	51.0	50.7	50.1	49.4	49.0	48.5	48.0
36	53.9	53.6	53.3	53.0	52.7	52.3	52.3	51.9	51.8	51.3	51.0	50.5	49.9	49.4	48.9	48.3
37	54.3	54.0	53.7	53.4	53.1	52.8	52.5	52.3	52.8	51.7	51.4	50.8	50.3	49.8	49.2	48.7
38	54.7	54.4	54.1	53.8	53.5	53.2	52.9	52.6	52.3	52.0	51.8	51.3	50.7	50.1	49.6	49.1
39	55.0	54.7	54.4	54.1	53.9	53.6	53.3	53.0	52.7	52.4	52.1	51.8	51.1	50.5	50.0	49.5
40	55.4	55.1	54.8	54.5	54.2	54.0	53.7	53.4	53.1	52.8	52.5	52.0	51.5	50.9	50.4	49.9
41	55.8	55.5	55.2	54.9	54.6	54.4	54.1	53.8	53.5	53.2	53.0	52.4	51.9	51.3	50.9	50.3
42	56.2	55.9	55.6	55.4	55.1	54.8	54.5	54.3	53.9	53.7	53.4	52.8	52.3	51.8	51.2	50.7
43	56.4	56.4	56.1	55.8	55.5	55.2	54.9	54.6	54.4	54.1	53.8	53.3	52.7	52.3	51.7	51.2
44	57.1	56.8	56.5	56.2	55.9	55.7	55.4	55.1	54.8	54.5	54.3	53.7	53.2	52.7	52.2	51.6
46	57.3	57.2	57.0	56.7	56.4	56.1	55.8	55.6	55.3	55.0	54.7	54.2	53.7	53.1	52.6	52.1
46	58.0	57.7	57.4	57.1	56.9	56.6	56.3	56.0	55.8	55.5	55.3	54.7	54.3	53.6	53.1	52.6
47	58.3	58.3	57.9	57.6	57.3	57.1	56.8	56.5	56.3	56.0	55.7	55.3	54.7	54.1	53.6	53.1
48	58.9	58.7	58.4	58.1	57.8	57.6	57.3	57.4	56.7	56.5	56.3	55.7	55.3	54.7	54.1	53.6
49	59.6	59.2	58.9	58.4	58.3	58.1	57.8	57.5	57.3	57.0	56.7	56.2	55.7	55.2	54.7	54.2
50	60.0	59.7	59.4	59.1	58.8	58.6	58.3	58.1	57.8	57.5	57.4	56.7	56.3	55.7	55.2	54.7
51	60.3	60.2	59.9	59.7	59.4	59.1	58.9	58.6	58.3	58.1	57.8	57.5	56.8	56.3	55.8	55.3
52	61.0	60.7	60.5	60.3	59.9	59.7	59.4	59.3	58.9	58.6	58.4	57.8	57.4	56.9	56.3	55.9
53	61.6	61.3	61.0	60.8	60.5	60.3	60.0	59.7	59.5	59.2	59.0	58.5	58.0	57.5	57.0	56.5
54	62.1	61.9	61.6	61.3	61.1	60.8	60.6	60.3	60.1	59.8	59.6	59.1	58.6	58.1	57.6	57.1
56	62.7	62.4	62.3	61.9	61.7	61.4	61.2	60.9	60.7	60.4	60.2	59.7	59.3	58.7	58.2	57.6
56	62.3	62.0	62.8	62.3	62.3	62.0	61.8	61.3	61.3	61.0	60.8	60.3	59.6	59.3	58.9	58.4
57	63.9	63.8	63.4	63.1	62.9	62.6	62.4	62.2	61.9	61.7	61.4	60.9	60.5	60.0	59.5	59.1
58	64.3	64.3	64.0	63.5	63.5	63.3	63.0	62.6	62.6	62.3	62.1	61.4	61.1	60.7	60.3	59.8
59	65.1	64.9	64.4	64.4	64.3	63.9	63.7	63.5	63.2	63.0	62.7	62.3	61.8	61.4	60.9	60.5
60	65.8	65.5	65.3	65.1	64.4	64.6	64.4	64.1	63.9	63.7	63.4	63.0	62.5	62.1	61.8	61.3
61	66.4	66.2	66.0	65.7	65.5	65.3	65.0	64.8	64.6	64.4	64.1	63.7	63.2	62.8	62.4	61.9
62	67.1	66.9	66.6	66.4	66.3	66.0	65.7	65.5	65.3	65.1	64.9	64.4	64.0	63.5	63.1	62.7
63	67.8	67.6	67.3	67.1	66.9	66.7	66.3	66.3	66.0	65.8	65.6	65.3	64.7	64.3	63.9	63.5
64	68.3	68.3	68.0	67.9	67.6	67.6	67.3	67.0	66.5	66.8	66.3	65.9	65.5	65.1	64.7	64.3
65	69.2	69.0	68.8	68.5	68.3	68.1	67.9	67.7	67.6	67.3	67.1	66.7	66.3	65.9	65.8	65.1
66	69.9	69.7	69.5	69.3	69.1	68.9	68.7	68.5	68.3	68.1	67.9	67.5	67.1	66.7	66.3	65.9
67	70.6	70.4	70.2	70.0	69.8	69.6	69.4	69.2	69.0	68.9	68.7	68.3	67.9	67.5	67.1	66.7
68	71.4	71.2	71.0	70.8	70.6	70.4	70.2	70.0	69.8	69.7	69.5	69.1	68.7	68.3	68.0	67.6
69	72.1	72.0	71.8	71.6	71.4	71.2	71.0	70.8	70.6	70.5	70.3	69.9	69.5	69.2	68.9	68.5
70	72.9	72.7	72.5	72.4	72.2	72.0	71.8	71.7	71.5	71.3	71.1	70.8	70.4	70.1	69.7	69.4
71	73.7	73.5	73.3	73.2	73.0	72.8	72.6	72.5	72.3	72.1	72.0	71.6	71.3	71.0	70.6	70.3
72	74.5	74.3	74.1	74.0	73.8	73.7	73.5	73.4	73.2	73.0	72.8	72.3	72.2	71.9	71.5	71.2
73	75.3	75.1	74.9	74.8	74.6	74.5	74.3	74.2	74.0	73.9	73.7	73.4	73.1	72.8	72.5	72.2
74	76.1	76.0	75.8	75.7	75.5	75.4	75.2	75.1	74.9	74.8	74.6	74.3	74.0	73.7	73.4	73.1
75	76.9	76.8	76.6	76.5	76.3	76.2	76.0	75.1	75.0	75.7	75.5	75.2	74.9	74.7	74.4	74.1

	11.0	11.2	11.4	11.6	11.8	12.0	12.2	12.4	12.6	12.8	13.0	13.2	13.4	13.6	13.8	14.0
0	42.3	41.8	41.3	40.8	40.3	39.8	39.3	38.9	38.4	38.0	37.6	37.1	36.7	36.3	35.9	35.5
1	42.3	41.8	41.3	40.8	40.3	39.8	39.4	38.9	38.5	38.0	37.6	37.2	36.7	36.3	35.9	35.6
2	42.4	41.9	41.4	40.9	40.4	39.9	39.4	39.0	38.5	38.1	37.7	37.2	36.8	36.4	36.0	35.6
3	42.5	42.0	41.5	41.0	40.5	40.0	39.5	39.1	38.6	38.2	37.8	37.3	36.9	36.5	36.1	35.7
4	42.6	42.1	41.6	41.1	40.6	40.1	39.6	39.2	38.7	38.3	37.9	37.4	37.0	36.6	36.2	35.8
5	42.7	42.2	41.7	41.2	40.7	40.2	39.8	39.3	38.9	38.4	38.0	37.6	37.1	36.7	36.3	35.9
6	42.8	42.3	41.8	41.3	40.8	40.3	39.9	39.4	39.0	38.5	38.1	37.7	37.2	36.8	36.4	36.0
7	42.9	42.4	41.9	41.4	40.9	40.4	40.0	39.5	39.1	38.6	38.2	37.8	37.3	36.9	36.5	36.1
8	43.0	42.5	42.0	41.5	41.0	40.5	40.1	39.6	39.2	38.7	38.3	37.9	37.4	37.0	36.6	36.2
9	43.1	42.6	42.1	41.6	41.1	40.7	40.2	39.7	39.3	38.8	38.4	38.0	37.6	37.2	36.7	36.4
10	43.2	42.8	42.2	41.8	41.3	40.8	40.3	39.9	39.4	39.0	38.5	38.1	37.7	37.3	36.9	36.5
11	43.4	42.9	42.4	41.9	41.4	40.9	40.5	40.0	39.5	39.1	38.7	38.2	37.8	37.4	37.0	36.6
12	43.6	43.0	42.5	42.0	41.5	41.1	40.6	40.1	39.7	39.2	38.8	38.4	38.0	37.6	37.2	36.8
13	43.7	43.2	42.7	42.2	41.7	41.2	40.8	40.3	39.8	39.4	39.0	38.5	38.1	37.7	37.3	36.9
14	43.9	43.4	42.9	42.4	41.9	41.4	40.9	40.5	40.0	39.6	39.1	38.7	38.3	37.9	37.5	37.1
15	44.1	43.5	43.0	42.5	42.0	41.6	41.1	40.6	40.2	39.7	39.3	38.9	38.5	38.0	37.6	37.2
16	44.3	43.7	43.2	42.7	42.2	41.8	41.3	40.8	40.4	39.9	39.5	39.1	38.6	38.2	37.8	37.4
17	44.5	43.9	43.4	42.9	42.4	42.0	41.5	41.0	40.6	40.1	39.7	39.3	38.8	38.4	38.0	37.6
18	44.7	44.1	43.6	43.1	42.6	42.2	41.7	41.2	40.8	40.3	39.9	39.5	39.0	38.6	38.2	37.8
19	44.9	44.3	43.8	43.3	42.9	42.4	41.9	41.4	41.0	40.5	40.1	39.7	39.2	38.8	38.4	38.0
20	45.1	44.6	44.1	43.6	43.1	42.6	42.1	41.7	41.2	40.8	40.3	39.9	39.5	39.1	38.6	38.2
21	45.3	44.8	44.3	43.8	43.3	42.8	42.4	41.9	41.4	41.0	40.6	40.1	39.7	39.3	38.9	38.5
22	45.6	45.1	44.6	44.1	43.6	43.1	42.6	42.1	41.7	41.2	40.8	40.4	40.0	39.6	39.2	38.8
23	45.8	45.3	44.8	44.3	43.8	43.3	42.9	42.4	42.0	41.5	41.1	40.6	40.2	39.8	39.4	39.0
24	46.1	45.6	45.1	44.6	44.1	43.6	43.1	42.7	42.2	41.8	41.3	40.9	40.5	40.1	39.6	39.2
25	46.4	45.9	45.4	44.9	44.4	43.9	43.4	43.0	42.5	42.1	41.6	41.2	40.8	40.3	39.9	39.5
26	46.7	46.2	45.7	45.2	44.7	44.2	43.7	43.3	42.8	42.4	41.9	41.5	41.0	40.6	40.2	39.8
27	47.0	46.5	46.0	45.5	45.0	44.5	44.0	43.6	43.1	42.7	42.2	41.8	41.3	40.9	40.5	40.1
28	47.3	46.8	46.3	45.8	45.3	44.8	44.3	43.9	43.4	43.0	42.5	42.1	41.7	41.2	40.8	40.4
29	47.6	47.1	46.6	46.1	45.6	45.1	44.7	44.2	43.8	43.3	42.9	42.4	42.0	41.6	41.2	40.7
30	48.0	47.5	47.0	46.5	46.0	45.5	45.0	44.6	44.1	43.6	43.2	42.8	42.3	41.9	41.5	41.1
31	48.3	47.8	47.3	46.8	46.3	45.8	45.4	44.9	44.5	44.0	43.6	43.1	42.7	42.3	41.9	41.4
32	48.7	48.2	47.7	47.2	46.7	46.2	45.7	45.3	44.8	44.4	43.9	43.5	43.1	42.6	42.2	41.8
33	49.1	48.6	48.1	47.6	47.1	46.6	46.1	45.7	45.2	44.8	44.3	43.9	43.4	43.0	42.6	42.2
34	49.5	49.0	48.5	48.0	47.5	47.0	46.5	46.1	45.6	45.2	44.7	44.3	43.8	43.4	43.0	42.6
35	49.9	49.4	48.9	48.4	47.9	47.4	46.9	46.5	46.0	45.6	45.1	44.7	44.3	43.8	43.4	43.0
36	50.3	49.8	49.3	48.8	48.3	47.8	47.4	46.9	46.4	46.0	45.5	45.1	44.7	44.3	43.8	43.4
37	50.7	50.2	49.7	49.2	48.8	48.3	47.8	47.3	46.9	46.4	46.0	45.6	45.1	44.7	44.3	43.9
38	51.2	50.7	50.2	49.7	49.2	48.7	48.3	47.8	47.3	46.9	46.4	46.0	45.6	45.2	44.7	44.3
39	51.6	51.1	50.6	50.2	49.7	49.2	48.7	48.3	47.8	47.4	46.9	46.5	46.1	45.6	45.2	44.8
40	52.1	51.6	51.1	50.6	50.2	49.7	49.2	48.8	48.3	47.9	47.4	47.0	46.6	46.1	45.7	45.3
41	52.6	52.1	51.6	51.1	50.7	50.2	49.7	49.3	48.8	48.4	47.9	47.5	47.1	46.6	46.2	45.8
42	53.1	52.6	52.1	51.7	51.2	50.7	50.2	49.8	49.3	48.9	48.4	48.0	47.6	47.2	46.7	46.3
43	53.6	53.2	52.7	52.2	51.7	51.2	50.8	50.3	49.9	49.4	49.0	48.5	48.1	47.7	47.3	46.9
44	54.2	53.7	53.2	52.7	52.3	51.8	51.3	50.9	50.4	50.0	49.5	49.1	48.7	48.3	47.8	47.4
45	54.7	54.2	53.8	53.3	52.8	52.4	51.9	51.4	51.0	50.6	50.1	49.7	49.3	48.8	48.4	48.0
46	55.3	54.8	54.3	53.9	53.4	52.9	52.5	52.0	51.6	51.2	50.7	50.3	49.9	49.4	49.0	48.6
47	55.9	55.4	54.9	54.5	54.0	53.5	53.1	52.6	52.2	51.8	51.3	50.9	50.5	50.1	49.6	49.2
48	56.5	56.0	55.5	55.1	54.6	54.2	53.7	53.3	52.8	52.4	52.0	51.5	51.1	50.7	50.3	49.9
49	57.1	56.6	56.2	55.7	55.3	54.8	54.4	53.9	53.5	53.0	52.6	52.2	51.8	51.4	51.0	50.5
50	57.8	57.3	56.8	56.4	55.9	55.5	55.0	54.6	54.1	53.7	53.3	52.9	52.5	52.0	51.6	51.2
51	58.4	57.9	57.5	57.0	56.6	56.1	55.7	55.3	54.8	54.4	54.0	53.6	53.2	52.7	52.3	51.9
52	59.1	58.6	58.2	57.7	57.3	56.8	56.4	56.0	55.5	55.1	54.7	54.3	53.9	53.5	53.1	52.7
53	59.8	59.3	58.9	58.4	58.0	57.5	57.1	56.7	56.3	55.9	55.4	55.0	54.6	54.2	53.8	53.4
54	60.5	60.0	59.6	59.1	58.7	58.3	57.9	57.4	57.0	56.6	56.2	55.8	55.4	55.0	54.6	54.2
55	61.2	60.8	60.3	59.9	59.5	59.0	58.6	58.2	57.8	57.4	57.0	56.6	56.2	55.8	55.4	55.0
56	61.9	61.5	61.1	60.6	60.2	59.8	59.4	59.0	58.6	58.2	57.8	57.4	57.0	56.6	56.2	55.8
57	62.7	62.3	61.8	61.4	61.0	60.6	60.2	59.8	59.4	59.0	58.6	58.2	57.8	57.4	57.1	56.7
58	63.5	63.0	62.6	62.2	61.8	61.4	61.0	60.6	60.2	59.8	59.5	59.1	58.7	58.3	57.9	57.6
59	64.3	63.9	63.4	63.0	62.6	62.2	61.9	61.5	61.1	60.7	60.3	59.9	59.6	59.2	58.8	58.5
60	65.1	64.7	64.3	63.9	63.5	63.1	62.7	62.3	62.0	61.6	61.2	60.8	60.5	60.1	59.7	59.4
61	65.9	65.5	65.1	64.7	64.4	64.0	63.6	63.2	62.9	62.5	62.1	61.8	61.5	61.1	60.7	60.3
62	66.7	66.4	66.0	65.6	65.2	64.9	64.5	64.1	63.8	63.4	63.1	62.7	62.4	62.0	61.7	61.3
63	67.6	67.2	66.9	66.5	66.2	65.8	65.5	65.1	64.8	64.4	64.1	63.7	63.4	63.0	62.7	62.3
64	68.5	68.1	67.8	67.4	67.1	66.7	66.4	66.0	65.7	65.4	65.1	64.7	64.4	64.0	63.7	63.4
65	69.4	69.0	68.7	68.4	68.0	67.7	67.4	67.0	66.7	66.4	66.1	65.7	65.4	65.0	64.7	64.4
66	70.3	70.0	69.6	69.3	69.0	68.7	68.4	68.0	67.7	67.4	67.1	66.7	66.4	66.1	65.8	65.5
67	71.2	70.9	70.6	70.3	70.0	69.7	69.4	69.0	68.7	68.4	68.1	67.8	67.5	67.2	66.9	66.6
68	72.2	71.9	71.6	71.3	71.0	70.7	70.4	70.1	69.8	69.5	69.2	68.9	68.6	68.3	68.0	67.7
69	73.1	72.8	72.6	72.3	72.0	71.7	71.4	71.1	70.9	70.6	70.3	70.0	69.8	69.5	69.2	68.9
70	74.1	73.8	73.6	73.3	73.0	72.7	72.5	72.2	72.0	71.7	71.4	71.1	70.9	70.6	70.4	70.1

C (3)	14.0	14.2	14.4	14.6	14.8	15.0	15.2	15.4	15.6	15.8	16.0	16.2	16.4	16.6	16.8	17.0
0	35.5	35.2	34.8	34.4	34.0	33.7	33.3	33.0	32.7	32.3	32.0	31.7	31.4	31.1	30.8	30.5
2	35.6	35.2	34.8	34.4	34.1	33.7	33.3	33.0	32.7	32.3	32.0	31.7	31.4	31.1	30.8	30.5
4	35.6	35.3	34.9	34.5	34.1	33.8	33.4	33.1	32.8	32.4	32.1	31.8	31.5	31.2	30.8	30.5
6	35.7	35.4	35.0	34.6	34.2	33.9	33.5	33.2	32.9	32.5	32.2	31.9	31.6	31.3	30.9	30.7
8	35.8	35.5	35.1	34.7	34.3	34.0	33.6	33.3	33.0	32.6	32.3	32.0	31.7	31.4	31.0	30.8
10	35.9	35.6	35.2	34.8	34.4	34.1	33.7	33.4	33.1	32.7	32.4	32.1	31.8	31.5	31.1	30.9
11	36.0	35.7	35.3	34.9	34.5	34.2	33.8	33.5	33.1	32.8	32.5	32.2	31.9	31.5	31.2	30.9
12	36.1	35.8	35.4	35.0	34.6	34.3	33.9	33.6	33.2	32.9	32.6	32.3	31.9	31.6	31.3	31.0
13	36.2	35.9	35.5	35.1	34.7	34.4	34.0	33.7	33.3	33.0	32.7	32.4	32.0	31.7	31.3	31.1
14	36.4	36.0	35.6	35.2	34.9	34.5	34.1	33.8	33.5	33.1	32.8	32.5	32.1	31.8	31.5	31.2
16	36.5	36.1	35.7	35.3	35.0	34.6	34.3	33.9	33.6	33.2	32.9	32.6	32.3	31.9	31.6	31.3
17	36.6	36.2	35.8	35.5	35.1	34.7	34.4	34.0	33.7	33.4	33.0	32.7	32.4	32.1	31.8	31.5
18	36.8	36.4	36.0	35.6	35.2	34.9	34.5	34.2	33.8	33.5	33.2	32.8	32.5	32.2	31.9	31.6
19	36.9	36.5	36.1	35.8	35.4	35.0	34.7	34.3	34.0	33.6	33.3	33.0	32.7	32.4	32.0	31.7
20	37.1	36.7	36.3	35.9	35.5	35.2	34.8	34.5	34.1	33.8	33.3	33.1	32.8	32.5	32.2	31.9
21	37.2	36.8	36.5	36.1	35.7	35.4	35.0	34.6	34.3	34.0	33.6	33.3	33.0	32.7	32.4	32.0
22	37.4	37.0	36.6	36.3	35.9	35.5	35.2	34.8	34.5	34.1	33.8	33.5	33.1	32.8	32.5	32.2
23	37.6	37.2	36.8	36.5	36.1	35.7	35.4	35.0	34.7	34.3	34.0	33.7	33.3	33.0	32.7	32.4
24	37.8	37.4	37.0	36.7	36.3	35.9	35.6	35.2	34.9	34.5	34.2	33.8	33.5	33.2	32.9	32.6
25	38.0	37.6	37.2	36.9	36.5	36.1	35.8	35.4	35.1	34.7	34.4	34.0	33.7	33.4	33.1	32.8
26	38.2	37.8	37.5	37.1	36.7	36.3	36.0	35.6	35.3	34.9	34.6	34.3	33.9	33.6	33.3	33.0
27	38.5	38.1	37.7	37.3	36.9	36.6	36.2	35.8	35.5	35.1	34.8	34.5	34.2	33.8	33.5	33.2
28	38.7	38.3	37.9	37.6	37.2	36.8	36.4	36.1	35.7	35.4	35.0	34.7	34.4	34.1	33.7	33.4
29	39.0	38.6	38.2	37.8	37.4	37.1	36.7	36.3	36.0	35.6	35.3	35.0	34.6	34.3	34.0	33.7
30	39.2	38.8	38.4	38.1	37.7	37.3	36.9	36.6	36.2	35.9	35.5	35.2	34.9	34.6	34.2	33.9
31	39.5	39.1	38.7	38.3	38.0	37.6	37.2	36.9	36.5	36.2	35.8	35.5	35.1	34.8	34.5	34.2
32	39.8	39.4	39.0	38.6	38.2	37.9	37.5	37.1	36.8	36.4	36.1	35.8	35.4	35.1	34.8	34.5
33	40.1	39.7	39.3	38.9	38.5	38.2	37.8	37.4	37.1	36.7	36.4	36.1	35.7	35.4	35.1	34.7
34	40.4	40.0	39.6	39.2	38.9	38.5	38.1	37.7	37.4	37.0	36.7	36.4	36.0	35.7	35.4	35.0
35	40.7	40.3	39.9	39.6	39.2	38.8	38.4	38.1	37.7	37.4	37.0	36.7	36.3	36.0	35.7	35.4
36	41.1	40.7	40.3	39.9	39.5	39.1	38.8	38.4	38.0	37.7	37.3	37.0	36.7	36.3	36.0	35.7
37	41.4	41.0	40.6	40.3	39.9	39.5	39.1	38.8	38.4	38.0	37.7	37.3	37.0	36.7	36.3	36.0
38	41.8	41.4	41.0	40.6	40.2	39.9	39.5	39.1	38.8	38.4	38.0	37.7	37.4	37.0	36.7	36.4
39	42.2	41.8	41.4	41.0	40.6	40.2	39.9	39.5	39.1	38.8	38.4	38.1	37.7	37.4	37.1	36.7
40	42.6	42.2	41.8	41.4	41.0	40.6	40.3	39.9	39.5	39.2	38.8	38.5	38.1	37.8	37.4	37.1
41	43.0	42.6	42.2	41.8	41.4	41.0	40.7	40.3	39.9	39.6	39.2	38.9	38.5	38.2	37.8	37.5
42	43.4	43.0	42.6	42.2	41.8	41.5	41.1	40.7	40.3	40.0	39.6	39.3	38.9	38.6	38.3	37.9
43	43.9	43.5	43.1	42.7	42.3	41.9	41.5	41.1	40.8	40.4	40.1	39.7	39.4	39.0	38.7	38.4
44	44.3	43.9	43.5	43.1	42.7	42.4	42.0	41.6	41.2	40.9	40.5	40.2	39.8	39.5	39.1	38.8
45	44.8	44.4	44.0	43.6	43.2	42.8	42.4	42.1	41.7	41.3	41.0	40.6	40.3	39.9	39.6	39.3
46	45.3	44.9	44.5	44.1	43.7	43.3	42.9	42.6	42.2	41.8	41.5	41.1	40.8	40.4	40.1	39.8
47	45.8	45.4	45.0	44.6	44.2	43.8	43.4	43.1	42.7	42.3	42.0	41.6	41.3	40.9	40.6	40.3
48	46.3	45.9	45.5	45.1	44.7	44.3	44.0	43.6	43.2	42.9	42.5	42.1	41.8	41.5	41.1	40.8
49	46.9	46.5	46.1	45.7	45.3	44.9	44.5	44.1	43.8	43.4	43.0	42.7	42.3	42.0	41.7	41.3
50	47.4	47.0	46.6	46.2	45.8	45.5	45.1	44.7	44.3	44.0	43.6	43.3	42.9	42.6	42.2	41.9
51	48.0	47.6	47.2	46.8	46.4	46.1	45.7	45.3	44.9	44.6	44.2	43.8	43.5	43.1	42.8	42.5
52	48.6	48.2	47.8	47.4	47.0	46.7	46.3	45.9	45.5	45.2	44.8	44.4	44.1	43.7	43.4	43.1
53	49.2	48.8	48.4	48.0	47.7	47.3	46.9	46.5	46.2	45.8	45.4	45.1	44.7	44.4	44.0	43.7
54	49.9	49.5	49.1	48.7	48.3	47.9	47.5	47.2	46.8	46.4	46.1	45.7	45.4	45.0	44.7	44.3
55	50.5	50.1	49.8	49.4	49.0	48.6	48.2	47.8	47.5	47.1	46.8	46.4	46.1	45.7	45.4	45.0
56	51.3	50.8	50.5	50.1	49.7	49.3	48.9	48.5	48.2	47.8	47.5	47.1	46.8	46.4	46.1	45.7
57	51.9	51.5	51.2	50.8	50.4	50.0	49.6	49.3	48.9	48.5	48.2	47.8	47.5	47.1	46.8	46.4
58	52.7	52.3	51.9	51.5	51.1	50.8	50.4	50.0	49.6	49.3	48.9	48.6	48.2	47.9	47.5	47.2
59	53.4	53.0	52.7	52.3	51.9	51.5	51.1	50.8	50.4	50.1	49.7	49.4	49.0	48.7	48.3	48.0
60	54.2	53.8	53.4	53.1	52.7	52.3	51.9	51.6	51.2	50.9	50.5	50.2	49.8	49.5	49.1	48.8
61	55.0	54.6	54.2	53.9	53.5	53.1	52.8	52.4	52.0	51.7	51.3	51.0	50.6	50.3	50.0	49.6
62	55.8	55.5	55.1	54.7	54.3	54.0	53.6	53.3	52.9	52.5	52.2	51.9	51.5	51.2	50.8	50.5
63	56.7	56.3	55.9	55.6	55.2	54.8	54.5	54.1	53.8	53.4	53.1	52.8	52.4	52.1	51.7	51.4
64	57.6	57.2	56.8	56.5	56.1	55.7	55.4	55.0	54.7	54.3	54.0	53.7	53.3	53.0	52.7	52.3
65	58.5	58.1	57.7	57.4	57.0	56.7	56.3	56.0	55.6	55.3	55.0	54.6	54.3	54.0	53.6	53.3
66	59.4	59.0	58.7	58.3	58.0	57.6	57.3	56.9	56.6	56.3	55.9	55.6	55.3	54.9	54.6	54.3
67	60.3	60.0	59.6	59.3	59.0	58.7	58.3	58.0	57.6	57.3	56.9	56.6	56.3	56.0	55.7	55.4
68	61.3	61.0	60.6	60.3	60.0	59.7	59.3	59.0	58.6	58.3	58.0	57.7	57.3	57.0	56.7	56.4
69	62.3	62.0	61.7	61.3	61.0	60.7	60.3	60.0	59.7	59.4	59.1	58.8	58.4	58.1	57.8	57.5
70	63.4	63.1	62.7	62.4	62.1	61.8	61.4	61.1	60.8	60.5	60.2	59.9	59.6	59.3	59.0	58.6
71	64.4	64.1	63.8	63.5	63.2	62.9	62.5	62.2	61.9	61.6	61.3	61.0	60.7	60.4	60.1	59.8
72	65.5	65.2	64.9	64.6	64.3	64.0	63.7	63.4	63.1	62.8	62.5	62.2	61.9	61.6	61.3	61.0
73	66.6	66.3	66.0	65.7	65.4	65.2	64.9	64.6	64.3	64.0	63.7	63.4	63.1	62.9	62.6	62.3
74	67.7	67.5	67.2	66.9	66.6	66.3	66.0	65.8	65.5	65.2	64.9	64.7	64.4	64.1	63.8	63.6
75	68.9	68.7	68.4	68.1	67.8	67.5	67.2	67.0	66.7	66.5	66.2	66.0	65.7	65.5	65.2	64.9
76	70.1	69.9	69.6	69.3	69.0	68.8	68.5	68.3	68.0	67.8	67.5	67.2	67.0	66.8	66.5	66.2

3	17.2	17.6	18.0	18.4	18.8	19.2	19.6	20.0	20.4	20.8	21.2	21.6	22.0	22.4	22.8	23.2	23.6	
0	30.2	29.6	29.1	28.5	28.0	27.5	27.0	26.6	26.1	25.7	25.2	24.8	24.4	24.0	23.7	23.3	23.0	0
5	30.3	29.7	29.2	28.6	28.1	27.6	27.1	26.7	26.2	25.8	25.3	24.9	24.5	24.1	23.8	23.4	23.0	5
10	30.6	30.0	29.4	28.9	28.4	27.9	27.4	26.9	26.5	26.0	25.6	25.2	24.8	24.4	24.0	23.6	23.3	10
14	30.9	30.4	29.8	29.3	28.7	28.2	27.7	27.3	26.8	26.4	25.9	25.5	25.1	24.7	24.3	24.0	23.6	14
18	31.4	30.9	30.3	29.7	29.2	28.7	28.2	27.7	27.3	26.8	26.4	26.0	25.6	25.2	24.8	24.4	24.0	18
20	31.8	31.2	30.6	30.0	29.5	29.0	28.5	28.0	27.6	27.1	26.7	26.2	25.8	25.4	25.0	24.6	24.3	20
22	32.1	31.5	30.9	30.4	29.8	29.3	28.8	28.3	27.9	27.4	27.0	26.5	26.1	25.7	25.3	24.9	24.6	22
24	32.5	31.9	31.3	30.8	30.2	29.7	29.2	28.7	28.2	27.8	27.3	26.9	26.5	26.1	25.7	25.3	24.9	24
26	32.9	32.3	31.7	31.2	30.6	30.1	29.6	29.1	28.6	28.2	27.7	27.3	26.8	26.4	26.0	25.6	25.2	26
28	33.4	32.8	32.2	31.6	31.1	30.5	30.0	29.5	29.0	28.6	28.1	27.7	27.2	26.8	26.4	26.0	25.6	28
30	33.9	33.3	32.7	32.1	31.6	31.0	30.5	30.0	29.5	29.0	28.6	28.1	27.7	27.3	26.9	26.5	26.1	30
31	34.1	33.5	32.9	32.4	31.8	31.3	30.8	30.3	29.8	29.3	28.8	28.4	27.9	27.5	27.1	26.7	26.3	31
32	34.4	33.8	33.2	32.7	32.1	31.6	31.0	30.5	30.0	29.6	29.1	28.6	28.2	27.8	27.3	26.9	26.5	32
33	34.7	34.1	33.5	32.9	32.4	31.8	31.3	30.8	30.3	29.8	29.4	28.9	28.5	28.0	27.6	27.2	26.8	33
34	35.0	34.4	33.8	33.2	32.7	32.1	31.6	31.1	30.6	30.1	29.6	29.2	28.7	28.3	27.9	27.5	27.1	34
35	35.4	34.7	34.1	33.6	33.0	32.4	31.9	31.4	30.9	30.4	29.9	29.5	29.0	28.6	28.2	27.8	27.4	35
36	35.7	35.1	34.5	33.9	33.3	32.8	32.2	31.7	31.2	30.7	30.3	29.8	29.3	28.9	28.5	28.1	27.7	36
37	36.1	35.4	34.8	34.2	33.7	33.1	32.6	32.1	31.6	31.1	30.6	30.1	29.6	29.2	28.8	28.4	28.0	37
38	36.4	35.8	35.2	34.6	34.0	33.5	32.9	32.4	31.9	31.4	30.9	30.4	30.0	29.5	29.1	28.7	28.3	38
39	36.8	36.2	35.6	35.0	34.4	33.8	33.3	32.8	32.3	31.8	31.3	30.8	30.3	29.9	29.4	29.0	28.6	39
40	37.2	36.6	36.0	35.4	34.8	34.2	33.7	33.1	32.6	32.1	31.6	31.2	30.7	30.2	29.8	29.4	28.9	40
41	37.6	37.0	36.4	35.8	35.2	34.6	34.1	33.5	33.0	32.5	32.0	31.5	31.1	30.6	30.2	29.7	29.3	41
42	38.0	37.4	36.8	36.2	35.6	35.0	34.5	33.9	33.4	32.9	32.4	31.9	31.5	31.0	30.5	30.1	29.7	42
43	38.5	37.8	37.2	36.6	36.0	35.5	34.9	34.4	33.8	33.3	32.8	32.3	31.9	31.4	31.0	30.5	30.1	43
44	38.9	38.3	37.7	37.1	36.5	35.9	35.3	34.8	34.3	33.8	33.3	32.8	32.3	31.8	31.4	30.9	30.5	44
45	39.4	38.8	38.2	37.6	37.0	36.4	35.8	35.3	34.7	34.2	33.7	33.2	32.7	32.3	31.8	31.4	30.9	45
46	39.9	39.3	38.7	38.1	37.5	36.9	36.3	35.7	35.2	34.7	34.2	33.7	33.2	32.7	32.3	31.8	31.4	46
47	40.4	39.8	39.2	38.6	38.0	37.4	36.8	36.2	35.7	35.2	34.7	34.2	33.7	33.2	32.7	32.3	31.9	47
48	41.0	40.3	39.7	39.1	38.5	37.9	37.3	36.8	36.2	35.7	35.2	34.7	34.2	33.7	33.2	32.8	32.4	48
49	41.5	40.9	40.3	39.6	39.0	38.4	37.9	37.3	36.8	36.2	35.7	35.2	34.7	34.2	33.8	33.3	32.9	49
50	42.1	41.5	40.8	40.2	39.6	39.0	38.4	37.9	37.3	36.8	36.3	35.8	35.3	34.8	34.3	33.8	33.4	50
51	42.7	42.1	41.4	40.8	40.2	39.6	39.0	38.5	37.9	37.4	36.9	36.3	35.8	35.3	34.9	34.4	34.0	51
52	43.4	42.7	42.1	41.4	40.8	40.2	39.6	39.1	38.5	38.0	37.5	36.9	36.4	35.9	35.5	35.0	34.5	52
53	44.0	43.4	42.7	42.1	41.5	40.9	40.3	39.7	39.2	38.6	38.1	37.6	37.1	36.6	36.1	35.6	35.1	53
54	44.7	44.0	43.4	42.8	42.1	41.5	41.0	40.4	39.8	39.3	38.7	38.2	37.7	37.2	36.7	36.3	35.8	54
55	45.4	44.7	44.1	43.5	42.8	42.2	41.7	41.1	40.5	40.0	39.4	38.9	38.4	37.9	37.4	36.9	36.5	55
56	46.1	45.5	44.8	44.2	43.6	43.0	42.4	41.8	41.2	40.7	40.1	39.6	39.1	38.6	38.1	37.6	37.2	56
57	46.9	46.2	45.6	44.9	44.3	43.7	43.1	42.6	42.0	41.4	40.9	40.4	39.8	39.3	38.8	38.4	37.9	57
58	47.7	47.0	46.4	45.7	45.1	44.5	43.9	43.4	42.8	42.2	41.7	41.2	40.6	40.1	39.6	39.1	38.6	58
59	48.5	47.8	47.2	46.5	45.9	45.3	44.7	44.2	43.6	43.0	42.5	42.0	41.4	40.9	40.4	39.9	39.4	59
60	49.3	48.7	48.0	47.4	46.8	46.2	45.6	45.0	44.4	43.9	43.3	42.8	42.3	41.8	41.3	40.8	40.3	60
61	50.2	49.5	48.9	48.3	47.7	47.1	46.5	45.9	45.3	44.8	44.2	43.7	43.2	42.7	42.2	41.7	41.2	61
62	51.1	50.4	49.8	49.2	48.6	48.0	47.4	46.8	46.2	45.7	45.1	44.6	44.1	43.6	43.1	42.6	42.1	62
63	52.0	51.4	50.7	50.1	49.5	48.9	48.3	47.8	47.2	46.6	46.1	45.6	45.0	44.5	44.0	43.5	43.0	63
64	53.0	52.4	51.7	51.1	50.5	49.9	49.3	48.8	48.2	47.6	47.1	46.6	46.0	45.5	45.0	44.5	44.0	64
65	54.0	53.4	52.7	52.1	51.5	50.9	50.4	49.8	49.2	48.7	48.1	47.6	47.1	46.6	46.1	45.6	45.1	65
66	55.0	54.4	53.8	53.2	52.6	52.0	51.4	50.9	50.3	49.8	49.2	48.7	48.2	47.7	47.2	46.7	46.2	66
67	56.1	55.5	54.9	54.3	53.7	53.1	52.6	52.0	51.4	50.9	50.4	49.8	49.3	48.8	48.3	47.8	47.3	67
68	57.2	56.6	56.0	55.4	54.8	54.3	53.7	53.2	52.6	52.1	51.5	51.0	50.5	50.0	49.5	49.0	48.5	68
69	58.4	57.8	57.2	56.6	56.0	55.5	54.9	54.4	53.8	53.3	52.8	52.2	51.8	51.3	50.8	50.3	49.8	69
70	59.5	58.9	58.4	57.8	57.2	56.7	56.2	55.6	55.1	54.6	54.0	53.5	53.0	52.6	52.1	51.6	51.1	70
71	60.7	60.2	59.6	59.1	58.5	58.0	57.5	56.9	56.4	55.9	55.4	54.9	54.4	53.9	53.4	52.9	52.5	71
72	62.0	61.4	60.9	60.4	59.8	59.3	58.8	58.3	57.8	57.3	56.8	56.3	55.8	55.3	54.8	54.4	53.9	72
73	63.3	62.8	62.2	61.7	61.2	60.7	60.2	59.7	59.2	58.7	58.2	57.7	57.3	56.8	56.3	55.9	55.4	73
74	64.6	64.1	63.6	63.1	62.6	62.1	61.6	61.1	60.6	60.2	59.7	59.2	58.8	58.3	57.9	57.4	56.9	74
75	66.0	65.5	65.0	64.5	64.0	63.6	63.1	62.6	62.2	61.7	61.2	60.8	60.3	59.9	59.5	59.0	58.6	75

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	24.0	24.5	25.0	25.5	26.0	26.5	27.0	27.5	28.0	29.0	30.0	31.0	32.0	33.0	34.0	35.0	
0	22.6	22.2	21.8	21.4	21.0	20.7	20.3	20.0	19.7	19.0	18.4	17.9	17.4	16.9	16.4	15.9	0
5	22.7	22.3	21.9	21.5	21.1	20.8	20.4	20.1	19.7	19.1	18.5	17.9	17.4	16.9	16.4	15.8	5
10	22.9	22.5	22.1	21.7	21.3	21.0	20.6	20.3	19.9	19.3	18.7	18.1	17.6	17.1	16.6	16.2	10
14	23.2	22.8	22.4	22.0	21.6	21.3	20.9	20.5	20.2	19.6	19.0	18.4	17.9	17.4	16.9	16.4	14
18	23.7	23.2	22.8	22.4	22.0	21.6	21.3	20.9	20.6	19.9	19.3	18.7	18.2	17.7	17.2	16.7	18
20	23.9	23.5	23.1	22.7	22.3	21.9	21.5	21.2	20.8	20.2	19.5	18.9	18.4	17.9	17.4	16.9	20
22	24.2	23.8	23.3	22.9	22.5	22.2	21.8	21.4	21.1	20.4	19.8	19.2	18.6	18.1	17.6	17.1	22
24	24.5	24.1	23.6	23.2	22.8	22.5	22.1	21.7	21.4	20.7	20.0	19.4	18.9	18.4	17.8	17.4	24
26	24.9	24.4	24.0	23.5	23.2	22.8	22.4	22.0	21.7	21.0	20.3	19.7	19.2	18.6	18.1	17.6	26
28	25.3	24.8	24.4	23.9	23.5	23.1	22.8	22.4	22.0	21.3	20.7	20.1	19.5	18.9	18.4	17.9	28
30	25.7	25.2	24.8	24.4	23.9	23.5	23.2	22.8	22.4	21.7	21.1	20.4	19.8	19.3	18.8	18.3	30
31	25.9	25.5	25.0	24.6	24.2	23.8	23.4	23.0	22.6	21.9	21.2	20.6	20.0	19.5	18.9	18.4	31
32	26.2	25.7	25.3	24.8	24.4	24.0	23.8	23.2	22.8	22.1	21.5	20.8	20.2	19.7	19.1	18.6	32
33	26.4	26.0	25.5	25.1	24.6	24.2	23.8	23.4	23.1	22.4	21.7	21.0	20.4	19.9	19.3	18.8	33
34	26.7	26.2	25.8	25.3	24.9	24.5	24.1	23.7	23.3	22.6	21.9	21.3	20.7	20.1	19.5	19.0	34
35	27.0	26.5	26.0	25.6	25.2	24.7	24.3	23.9	23.6	22.8	22.1	21.5	20.9	20.3	19.8	19.2	35
36	27.3	26.8	26.3	25.9	25.4	25.0	24.6	24.2	23.8	23.1	22.4	21.7	21.1	20.5	20.0	19.5	36
37	27.6	27.1	26.6	26.2	25.7	25.3	24.9	24.5	24.1	23.4	22.7	22.0	21.4	20.9	20.2	19.7	37
38	27.9	27.4	26.9	26.5	26.0	25.6	25.2	24.8	24.4	23.6	22.9	22.3	21.6	21.0	20.5	19.9	38
39	28.2	27.7	27.2	26.8	26.3	25.9	25.5	25.1	24.7	23.9	23.2	22.5	21.9	21.3	20.7	20.2	39
40	28.5	28.1	27.6	27.1	26.7	26.2	25.8	25.4	25.0	24.2	23.5	22.8	22.2	21.6	21.0	20.5	40
41	28.9	28.4	27.9	27.5	27.0	26.6	26.1	25.7	25.3	24.6	23.9	23.1	22.5	21.9	21.3	20.7	41
42	29.3	28.8	28.3	27.8	27.4	26.9	26.5	26.1	25.7	24.9	24.2	23.5	22.8	22.2	21.6	21.0	42
43	29.7	29.2	28.7	28.2	27.7	27.3	26.9	26.4	26.0	25.2	24.5	23.8	23.1	22.5	21.9	21.3	43
44	30.1	29.6	29.1	28.6	28.1	27.7	27.2	26.8	26.4	25.6	24.9	24.2	23.5	22.8	22.2	21.7	44
45	30.5	30.0	29.5	29.0	28.5	28.1	27.6	27.2	26.8	26.0	25.2	24.5	23.8	23.1	22.5	22.0	45
46	31.0	30.4	29.9	29.5	29.0	28.6	28.1	27.6	27.2	26.4	25.6	24.9	24.2	23.6	22.9	22.4	46
47	31.4	30.9	30.4	29.9	29.4	29.0	28.5	28.1	27.6	26.8	26.0	25.3	24.6	23.9	23.3	22.7	47
48	31.9	31.4	30.9	30.4	29.9	29.4	29.0	28.5	28.1	27.3	26.5	25.7	25.0	24.4	23.7	23.1	48
49	32.4	31.9	31.4	30.9	30.4	29.9	29.4	29.0	28.6	27.7	26.9	26.2	25.5	24.8	24.1	23.5	49
50	33.0	32.4	31.9	31.4	30.9	30.4	30.0	29.5	29.1	28.2	27.4	26.6	25.9	25.2	24.6	24.0	50
51	33.5	33.0	32.4	31.9	31.4	30.9	30.5	30.0	29.6	28.7	27.9	27.1	26.4	25.7	25.0	24.4	51
52	34.1	33.5	33.0	32.5	32.0	31.5	31.0	30.6	30.1	29.3	28.5	27.7	26.9	26.2	25.5	24.9	52
53	34.7	34.1	33.6	33.1	32.6	32.1	31.6	31.1	30.7	29.8	29.0	28.2	27.4	26.7	26.0	25.4	53
54	35.3	34.8	34.2	33.7	33.2	32.7	32.2	31.7	31.3	30.4	29.6	28.8	28.0	27.3	26.6	25.9	54
55	36.0	35.4	34.9	34.4	33.8	33.4	32.9	32.4	31.9	31.0	30.2	29.4	28.6	27.9	27.1	26.5	55
56	36.7	36.1	35.6	35.1	34.5	34.0	33.5	33.1	32.6	31.7	30.8	30.0	29.2	28.5	27.7	27.1	56
57	37.4	36.8	36.3	35.8	35.2	34.7	34.2	33.8	33.3	32.4	31.3	30.6	29.8	29.1	28.4	27.7	57
58	38.2	37.6	37.0	36.5	36.0	35.5	35.0	34.5	34.0	33.1	32.2	31.3	30.5	29.8	29.0	28.3	58
59	39.0	38.4	37.8	37.3	36.8	36.3	35.7	35.2	34.7	33.8	32.9	32.1	31.2	30.5	29.7	29.0	59
60	39.8	39.2	38.7	38.1	37.6	37.1	36.5	36.0	35.5	34.6	33.7	32.8	32.0	31.2	30.5	29.8	60
61	40.7	40.1	39.5	39.0	38.4	37.9	37.4	36.9	36.4	35.4	34.5	33.6	32.8	32.0	31.2	30.5	61
62	41.6	41.0	40.4	39.9	39.3	38.8	38.3	37.8	37.3	36.3	35.4	34.5	33.6	32.8	32.1	31.3	62
63	42.5	42.0	41.4	40.8	40.3	39.7	39.2	38.7	38.2	37.2	36.3	35.4	34.5	33.7	32.9	32.2	63
64	43.5	43.0	42.4	41.8	41.3	40.7	40.2	39.7	39.2	38.2	37.3	36.4	35.5	34.7	33.9	33.1	64
65	44.6	44.0	43.4	42.9	42.3	41.8	41.2	40.7	40.2	39.2	38.3	37.4	36.5	35.7	34.9	34.1	65
66	45.7	45.1	44.5	44.0	43.4	42.9	42.3	41.8	41.3	40.3	39.3	38.4	37.6	36.7	35.9	35.1	66
67	46.8	46.2	45.7	45.1	44.6	44.0	43.5	42.9	42.4	41.4	40.5	39.5	38.7	37.8	37.0	36.2	67
68	48.0	47.4	46.9	46.3	45.8	45.2	44.7	44.1	43.6	42.6	41.7	40.7	39.8	39.0	38.1	37.3	68
69	49.3	48.7	48.2	47.6	47.0	46.5	45.9	45.4	44.9	43.9	42.9	42.0	41.1	40.2	39.4	38.6	69
70	50.5	50.0	49.5	48.9	48.4	47.8	47.3	46.8	46.2	45.2	44.3	43.3	42.4	41.5	40.7	39.9	70
71	52.0	51.4	50.9	50.3	49.8	49.2	48.8	48.3	47.7	46.7	45.7	44.7	43.8	42.9	42.1	41.3	71
72	53.4	52.9	52.4	51.8	51.2	50.7	50.2	49.7	49.2	48.2	47.2	46.2	45.3	44.4	43.6	42.7	72
73	54.9	54.4	53.9	53.3	52.8	52.2	51.7	51.2	50.7	49.7	48.8	47.8	46.9	46.0	45.2	44.3	73
74	56.5	56.0	55.5	54.9	54.4	53.9	53.4	52.8	52.3	51.4	50.4	49.5	48.6	47.7	46.9	46.0	74
75	58.1	57.6	57.1	56.6	56.1	55.6	55.1	54.6	54.1	53.1	52.2	51.3	50.4	49.5	48.7	47.8	75

105

	35.0	36.0	37.0	38.0	39.0	40.0	41.0	42.0	43.0	44.0	45.0	46.0	47.0	48.0	49.0	50.0	
3	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
4	15.9	15.5	15.1	14.7	14.4	14.0	13.7	13.4	13.1	12.8	12.5	12.3	12.0	11.8	11.5	11.3	0
5	16.0	15.6	15.2	14.8	14.4	14.1	13.8	13.5	13.2	12.9	12.6	12.3	12.1	11.8	11.6	11.4	5
6	16.2	15.8	15.4	15.0	14.6	14.2	13.9	13.6	13.3	13.0	12.7	12.4	12.2	11.9	11.7	11.5	10
7	16.4	16.0	15.6	15.2	14.8	14.4	14.1	13.8	13.5	13.2	12.9	12.6	12.4	12.1	11.9	11.6	14
8	16.7	16.3	15.9	15.5	15.1	14.7	14.4	14.1	13.7	13.4	13.1	12.9	12.6	12.4	12.1	11.9	18
9	16.9	16.5	16.0	15.6	15.3	14.9	14.6	14.2	13.9	13.6	13.3	13.0	12.8	12.5	12.3	12.0	20
10	17.1	16.7	16.3	15.8	15.5	15.1	14.7	14.4	14.1	13.8	13.5	13.2	12.9	12.7	12.4	12.2	22
11	17.4	16.9	16.5	16.1	15.7	15.3	14.9	14.6	14.3	14.0	13.7	13.4	13.1	12.8	12.6	12.3	24
12	17.6	17.2	16.7	16.3	15.9	15.5	15.2	14.8	14.5	14.2	13.9	13.6	13.3	13.1	12.8	12.5	26
13	17.9	17.5	17.0	16.6	16.2	15.8	15.4	15.1	14.8	14.4	14.1	13.8	13.5	13.3	13.0	12.8	28
14	18.3	17.8	17.3	16.9	16.5	16.1	15.7	15.4	15.0	14.7	14.4	14.1	13.8	13.5	13.3	13.0	30
15	18.4	18.0	17.5	17.1	16.7	16.3	15.9	15.5	15.2	14.9	14.5	14.2	13.9	13.7	13.4	13.1	31
16	18.6	18.1	17.7	17.2	16.8	16.4	16.0	15.7	15.3	15.0	14.7	14.4	14.1	13.8	13.5	13.3	32
17	18.8	18.3	17.9	17.4	17.0	16.6	16.2	15.8	15.5	15.2	14.9	14.5	14.2	14.0	13.7	13.4	33
18	19.0	18.5	18.1	17.6	17.2	16.8	16.4	16.0	15.7	15.3	15.0	14.7	14.4	14.1	13.8	13.6	34
19	19.2	18.7	18.3	17.8	17.4	17.0	16.6	16.2	15.9	15.5	15.2	14.9	14.6	14.3	14.0	13.7	35
20	19.5	19.0	18.5	18.0	17.6	17.2	16.8	16.4	16.1	15.7	15.4	15.0	14.7	14.4	14.2	13.9	36
21	19.7	19.2	18.7	18.2	17.8	17.4	17.0	16.6	16.3	15.9	15.6	15.2	14.9	14.6	14.3	14.1	37
22	19.9	19.4	18.9	18.5	18.0	17.6	17.2	16.8	16.5	16.1	15.8	15.4	15.1	14.8	14.5	14.2	38
23	20.2	19.7	19.2	18.7	18.3	17.8	17.4	17.0	16.7	16.3	16.0	15.6	15.3	15.0	14.7	14.4	39
24	20.5	19.9	19.4	19.0	18.5	18.1	17.7	17.3	16.9	16.5	16.2	15.8	15.5	15.2	14.9	14.6	40
25	20.7	20.2	19.7	19.2	18.8	18.3	17.9	17.5	17.1	16.8	16.4	16.1	15.7	15.4	15.1	14.8	41
26	21.0	20.5	20.0	19.5	19.0	18.6	18.2	17.8	17.4	17.0	16.7	16.3	16.0	15.7	15.4	15.1	42
27	21.3	20.8	20.3	19.8	19.3	18.9	18.4	18.0	17.6	17.3	16.9	16.6	16.2	15.9	15.6	15.3	43
28	21.7	21.1	20.6	20.1	19.6	19.2	18.7	18.3	17.9	17.5	17.2	16.8	16.5	16.2	15.8	15.5	44
29	22.0	21.4	20.9	20.4	19.9	19.5	19.0	18.6	18.2	17.8	17.5	17.1	16.8	16.4	16.1	15.8	45
30	22.4	21.8	21.3	20.8	20.3	19.8	19.3	18.9	18.5	18.1	17.8	17.4	17.1	16.7	16.4	16.1	46
31	22.7	22.2	21.6	21.1	20.6	20.1	19.7	19.2	18.8	18.4	18.1	17.7	17.4	17.0	16.7	16.3	47
32	23.1	22.5	22.0	21.5	21.0	20.5	20.0	19.6	19.2	18.8	18.4	18.0	17.7	17.3	17.0	16.6	48
33	23.5	22.9	22.4	21.9	21.4	20.9	20.4	19.9	19.5	19.1	18.7	18.3	18.0	17.6	17.3	17.0	49
34	24.0	23.4	22.8	22.3	21.8	21.3	20.8	20.3	19.9	19.5	19.1	18.7	18.3	18.0	17.6	17.3	50
35	24.4	23.8	23.3	22.7	22.2	21.7	21.2	20.7	20.3	19.9	19.5	19.1	18.7	18.3	18.0	17.6	51
36	24.9	24.3	23.7	23.1	22.6	22.1	21.6	21.1	20.7	20.3	19.9	19.5	19.1	18.7	18.3	18.0	52
37	25.4	24.8	24.2	23.6	23.1	22.6	22.1	21.6	21.2	20.7	20.3	19.9	19.5	19.1	18.7	18.3	53
38	25.9	25.3	24.7	24.1	23.6	23.1	22.6	22.1	21.6	21.1	20.7	20.3	19.9	19.5	19.1	18.8	54
39	26.5	25.8	25.2	24.6	24.1	23.6	23.1	22.6	22.1	21.6	21.2	20.8	20.4	20.0	19.6	19.2	55
40	27.1	26.4	25.8	25.2	24.6	24.1	23.6	23.1	22.6	22.1	21.7	21.3	20.8	20.4	20.1	19.7	56
41	27.7	27.0	26.4	25.8	25.2	24.7	24.1	23.6	23.1	22.7	22.2	21.8	21.3	20.9	20.6	20.2	57
42	28.3	27.7	27.0	26.4	25.8	25.3	24.7	24.2	23.7	23.2	22.8	22.3	21.9	21.5	21.1	20.7	58
43	29.0	28.4	27.7	27.1	26.5	25.9	25.3	24.8	24.3	23.8	23.4	22.9	22.5	22.0	21.6	21.2	59
44	29.8	29.1	28.4	27.8	27.2	26.6	26.0	25.5	24.9	24.4	24.0	23.5	23.1	22.6	22.2	21.8	60
45	30.5	29.8	29.1	28.5	27.9	27.3	26.7	26.2	25.6	25.1	24.6	24.2	23.7	23.3	22.8	22.4	61
46	31.3	30.6	29.9	29.3	28.7	28.0	27.5	26.9	26.4	25.8	25.3	24.8	24.4	23.9	23.5	23.1	62
47	32.2	31.5	30.8	30.1	29.5	28.8	28.2	27.7	27.1	26.6	26.1	25.6	25.1	24.6	24.2	23.8	63
48	33.1	32.4	31.7	31.0	30.3	29.7	29.1	28.5	27.9	27.4	26.9	26.4	25.9	25.4	25.0	24.5	64
49	34.1	33.3	32.6	31.9	31.2	30.6	30.0	29.4	28.8	28.3	27.8	27.2	26.7	26.2	25.8	25.3	65
50	35.1	34.3	33.6	32.9	32.2	31.6	30.9	30.3	29.8	29.2	28.7	28.1	27.6	27.1	26.7	26.2	66
51	36.2	35.4	34.7	34.0	33.3	32.6	32.0	31.4	30.8	30.2	29.6	29.1	28.6	28.1	27.6	27.1	67
52	37.3	36.6	35.8	35.1	34.4	33.7	33.1	32.4	31.8	31.2	30.7	30.1	29.6	29.1	28.6	28.1	68
53	38.6	37.8	37.0	36.3	35.6	34.9	34.2	33.6	32.9	32.4	31.8	31.2	30.7	30.2	29.7	29.2	69
54	39.9	39.1	38.3	37.6	36.8	36.2	35.5	34.8	34.2	33.6	33.0	32.4	31.8	31.3	30.8	30.3	70
55	41.3	40.5	39.8	38.9	38.2	37.5	36.8	36.2	35.5	34.9	34.3	33.7	33.2	32.6	32.1	31.5	71
56	42.7	41.9	41.2	40.4	39.7	38.9	38.3	37.6	36.9	36.3	35.7	35.1	34.5	33.9	33.4	32.9	72
57	44.3	43.4	42.7	41.9	41.2	40.5	39.8	39.2	38.5	37.8	37.2	36.6	36.0	35.5	34.9	34.4	73
58	46.0	45.2	44.4	43.7	42.9	42.2	41.5	40.8	40.1	39.5	38.9	38.3	37.7	37.1	36.5	35.9	74
59	47.8	47.0	46.2	45.5	44.8	44.0	43.3	42.6	41.9	41.3	40.6	40.0	39.4	38.8	38.2	37.7	75

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	50.0	60.0	70.0	80.0	90.0	100	110	120	130	140	150	160	170	180	190	200
0	11.3	9.5	8.1	7.1	6.3	5.7	5.2	4.8	4.4	4.1	3.8	3.6	3.4	3.2	3.0	2.9
5	11.4	9.5	8.2	7.2	6.4	5.7	5.2	4.8	4.4	4.1	3.8	3.6	3.4	3.2	3.0	2.9
10	11.5	9.6	8.3	7.2	6.4	5.8	5.3	4.8	4.5	4.1	3.9	3.6	3.4	3.2	3.1	2.9
14	11.6	9.7	8.4	7.3	6.5	5.9	5.4	4.9	4.5	4.2	3.9	3.7	3.5	3.3	3.1	2.9
18	11.9	9.9	8.5	7.5	6.7	6.0	5.5	5.0	4.6	4.3	4.0	3.8	3.5	3.3	3.2	3.0
20	12.0	10.1	8.6	7.6	6.7	6.1	5.5	5.1	4.7	4.3	4.1	3.8	3.6	3.4	3.2	3.0
22	12.2	10.2	8.8	7.7	6.8	6.2	5.6	5.1	4.7	4.4	4.1	3.9	3.6	3.4	3.3	3.1
24	12.3	10.3	8.9	7.8	6.9	6.2	5.7	5.2	4.8	4.5	4.2	3.9	3.7	3.5	3.3	3.1
26	12.5	10.5	9.0	7.9	7.0	6.3	5.8	5.3	4.9	4.5	4.2	4.0	3.7	3.5	3.4	3.2
28	12.8	10.7	9.2	8.1	7.2	6.5	5.9	5.4	5.0	4.6	4.3	4.0	3.8	3.6	3.4	3.2
30	13.0	10.9	9.4	8.2	7.3	6.6	6.0	5.5	5.1	4.7	4.4	4.1	3.9	3.7	3.5	3.3
31	13.1	11.0	9.5	8.3	7.4	6.7	6.1	5.6	5.1	4.8	4.4	4.2	3.9	3.7	3.5	3.3
32	13.3	11.1	9.6	8.4	7.5	6.7	6.1	5.6	5.2	4.8	4.5	4.2	4.0	3.7	3.6	3.4
33	13.4	11.2	9.7	8.5	7.5	6.8	6.2	5.7	5.2	4.9	4.5	4.3	4.0	3.8	3.6	3.4
34	13.6	11.4	9.8	8.6	7.6	6.9	6.3	5.7	5.3	4.9	4.6	4.3	4.1	3.8	3.6	3.5
35	13.7	11.5	9.9	8.7	7.7	7.0	6.3	5.8	5.4	5.0	4.7	4.4	4.1	3.9	3.7	3.5
36	13.9	11.6	10.0	8.8	7.8	7.0	6.4	5.9	5.4	5.0	4.7	4.4	4.2	3.9	3.7	3.5
37	14.1	11.8	10.1	8.9	7.9	7.1	6.5	6.0	5.5	5.1	4.8	4.5	4.2	4.0	3.8	3.6
38	14.2	11.9	10.3	9.0	8.0	7.2	6.6	6.0	5.6	5.2	4.8	4.5	4.3	4.0	3.8	3.6
39	14.4	12.1	10.4	9.1	8.1	7.3	6.7	6.1	5.7	5.3	4.9	4.6	4.3	4.1	3.9	3.7
40	14.6	12.3	10.6	9.3	8.3	7.4	6.8	6.2	5.7	5.3	5.0	4.7	4.4	4.1	3.9	3.7
41	14.8	12.5	10.7	9.4	8.4	7.5	6.9	6.3	5.8	5.4	5.0	4.7	4.5	4.2	4.0	3.8
42	15.1	12.6	10.9	9.5	8.5	7.7	7.0	6.4	5.9	5.5	5.1	4.8	4.5	4.3	4.1	3.8
43	15.3	12.8	11.1	9.7	8.6	7.8	7.1	6.5	6.0	5.6	5.2	4.9	4.6	4.3	4.1	3.9
44	15.5	13.0	11.2	9.9	8.8	7.9	7.2	6.6	6.1	5.7	5.3	5.0	4.7	4.4	4.2	4.0
45	15.8	13.3	11.4	10.0	8.9	8.0	7.3	6.7	6.2	5.8	5.4	5.1	4.8	4.5	4.3	4.0
46	16.1	13.5	11.6	10.2	9.1	8.2	7.5	6.8	6.3	5.9	5.5	5.1	4.8	4.6	4.3	4.1
47	16.3	13.7	11.8	10.4	9.3	8.3	7.6	7.0	6.4	6.0	5.6	5.2	4.9	4.7	4.4	4.2
48	16.6	14.0	12.1	10.6	9.4	8.5	7.7	7.1	6.6	6.1	5.7	5.3	5.0	4.7	4.5	4.3
49	17.0	14.3	12.3	10.8	9.6	8.7	7.9	7.2	6.7	6.2	5.8	5.4	5.1	4.8	4.6	4.4
50	17.3	14.5	12.5	11.0	9.8	8.8	8.0	7.4	6.8	6.3	5.9	5.6	5.2	4.9	4.7	4.4
51	17.6	14.8	12.8	11.2	10.0	9.0	8.2	7.5	7.0	6.5	6.0	5.7	5.3	5.0	4.8	4.5
52	18.0	15.1	13.1	11.5	10.2	9.2	8.4	7.7	7.1	6.6	6.2	5.8	5.5	5.2	4.9	4.6
53	18.4	15.5	13.4	11.7	10.5	9.4	8.6	7.9	7.3	6.8	6.3	5.9	5.6	5.3	5.0	4.7
54	18.8	15.8	13.7	12.0	10.7	9.7	8.8	8.1	7.5	6.9	6.5	6.1	5.7	5.4	5.1	4.9
55	19.2	16.2	14.0	12.3	11.0	9.9	9.0	8.3	7.6	7.1	6.6	6.2	5.9	5.5	5.2	5.0
56	19.7	16.6	14.3	12.6	11.2	10.1	9.2	8.5	7.8	7.3	6.8	6.4	6.0	5.7	5.4	5.1
57	20.2	17.0	14.7	12.9	11.5	10.4	9.5	8.7	8.0	7.5	7.0	6.5	6.2	5.8	5.5	5.2
58	20.7	17.5	15.1	13.3	11.8	10.7	9.7	8.9	8.3	7.7	7.2	6.7	6.3	6.0	5.7	5.4
59	21.2	17.9	15.5	13.6	12.2	11.0	10.0	9.2	8.5	7.9	7.4	6.9	6.5	6.2	5.8	5.5
60	21.8	18.4	15.9	14.0	12.5	11.3	10.3	9.5	8.7	8.1	7.6	7.1	6.7	6.3	6.0	5.7
61	22.4	19.0	16.4	14.5	12.9	11.7	10.6	9.8	9.0	8.4	7.8	7.3	6.9	6.5	6.2	5.9
62	23.1	19.6	16.9	14.9	13.3	12.0	11.0	10.1	9.3	8.7	8.1	7.6	7.1	6.7	6.4	6.1
63	23.8	20.2	17.5	15.4	13.8	12.4	11.3	10.4	9.6	8.9	8.4	7.8	7.4	7.0	6.6	6.3
64	24.5	20.8	18.1	15.9	14.2	12.9	11.7	10.8	10.0	9.3	8.6	8.1	7.6	7.2	6.8	6.5
65	25.3	21.5	18.7	16.5	14.7	13.3	12.1	11.2	10.3	9.6	9.0	8.4	7.9	7.5	7.1	6.7
66	26.2	22.3	19.4	17.1	15.3	13.8	12.6	11.6	10.7	10.0	9.3	8.7	8.2	7.8	7.4	7.0
67	27.1	23.1	20.1	17.8	15.9	14.4	13.1	12.0	11.1	10.4	9.7	9.1	8.6	8.1	7.7	7.3
68	28.1	24.0	20.9	18.5	16.5	14.9	13.6	12.5	11.6	10.8	10.1	9.5	8.9	8.4	8.0	7.6
69	29.2	24.9	21.7	19.2	17.2	15.5	14.2	13.1	12.1	11.3	10.5	9.9	9.4	8.8	8.4	7.9
70	30.3	25.9	22.7	20.1	18.0	16.3	14.9	13.7	12.7	11.8	11.0	10.4	9.8	9.2	8.7	8.3
71	31.5	27.1	23.7	21.0	18.8	17.1	15.6	14.4	13.3	12.4	11.6	10.9	10.2	9.7	9.2	8.7
72	32.9	28.3	24.8	22.0	19.8	17.9	16.4	15.1	14.0	13.0	12.2	11.4	10.8	10.2	9.7	9.2
73	34.4	29.7	26.1	23.1	20.8	18.9	17.3	15.9	14.7	13.7	12.8	12.1	11.4	10.8	10.2	9.7
74	35.9	31.2	27.4	24.4	21.9	19.9	18.3	16.8	15.6	14.5	13.6	12.8	12.1	11.4	10.8	10.3
75	37.7	32.8	28.9	25.8	23.2	21.1	19.4	17.9	16.6	15.4	14.5	13.6	12.8	12.1	11.5	10.9

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	210	220	250	270	300	360	400	500	600	700	800	1000	1500	2000	4000	8000
0	2.7	2.6	2.3	2.1	1.9	1.6	1.4	1.1	1.0	0.8	0.7	0.6	0.4	0.3	0.1	0.1
5	2.7	2.6	2.3	2.1	1.9	1.6	1.4	1.2	1.0	0.8	0.7	0.6	0.4	0.3	0.1	0.1
10	2.8	2.6	2.3	2.2	1.9	1.6	1.5	1.2	1.0	0.8	0.7	0.6	0.4	0.3	0.1	0.1
14	2.8	2.7	2.4	2.2	2.0	1.6	1.5	1.2	1.0	0.8	0.7	0.6	0.4	0.3	0.1	0.1
18	2.9	2.7	2.4	2.2	2.0	1.7	1.5	1.2	1.0	0.9	0.8	0.6	0.4	0.3	0.2	0.1
20	2.9	2.8	2.4	2.2	2.0	1.7	1.5	1.2	1.0	0.9	0.8	0.6	0.4	0.3	0.2	0.1
22	2.9	2.8	2.5	2.3	2.1	1.7	1.5	1.2	1.0	0.9	0.8	0.6	0.4	0.3	0.2	0.1
24	3.0	2.8	2.5	2.3	2.1	1.7	1.6	1.3	1.0	0.9	0.8	0.6	0.4	0.3	0.2	0.1
26	3.0	2.9	2.5	2.4	2.1	1.8	1.6	1.3	1.1	0.9	0.8	0.6	0.4	0.3	0.2	0.1
28	3.1	2.9	2.6	2.4	2.2	1.8	1.6	1.3	1.1	0.9	0.8	0.6	0.4	0.3	0.2	0.1
30	3.1	3.0	2.6	2.4	2.2	1.8	1.7	1.3	1.1	0.9	0.8	0.7	0.4	0.3	0.2	0.1
31	3.2	3.0	2.7	2.5	2.2	1.9	1.7	1.3	1.1	1.0	0.8	0.7	0.4	0.3	0.2	0.1
32	3.2	3.1	2.7	2.5	2.3	1.9	1.7	1.4	1.1	1.0	0.8	0.7	0.5	0.3	0.2	0.1
33	3.2	3.1	2.7	2.5	2.3	1.9	1.7	1.4	1.1	1.0	0.9	0.7	0.5	0.3	0.2	0.1
34	3.3	3.1	2.8	2.6	2.3	1.9	1.7	1.4	1.2	1.0	0.9	0.7	0.5	0.3	0.2	0.1
35	3.3	3.2	2.8	2.6	2.3	2.0	1.7	1.4	1.2	1.0	0.9	0.7	0.5	0.3	0.2	0.1
36	3.4	3.2	2.8	2.6	2.4	2.0	1.8	1.4	1.2	1.0	0.9	0.7	0.5	0.4	0.2	0.1
37	3.4	3.3	2.9	2.7	2.4	2.0	1.8	1.4	1.2	1.0	0.9	0.7	0.5	0.4	0.2	0.1
38	3.5	3.3	2.9	2.7	2.4	2.0	1.8	1.5	1.2	1.0	0.9	0.7	0.5	0.4	0.2	0.1
39	3.5	3.3	2.9	2.7	2.5	2.0	1.8	1.5	1.2	1.0	0.9	0.7	0.5	0.4	0.2	0.1
40	3.6	3.4	3.0	2.8	2.5	2.1	1.9	1.5	1.2	1.1	0.9	0.7	0.5	0.4	0.2	0.1
41	3.6	3.4	3.0	2.8	2.5	2.1	1.9	1.5	1.3	1.1	1.0	0.8	0.5	0.4	0.2	0.1
42	3.7	3.5	3.1	2.9	2.6	2.1	1.9	1.5	1.3	1.1	1.0	0.8	0.5	0.4	0.2	0.1
43	3.7	3.6	3.1	2.9	2.6	2.2	2.0	1.6	1.3	1.1	1.0	0.8	0.5	0.4	0.2	0.1
44	3.8	3.6	3.2	2.9	2.7	2.2	2.0	1.6	1.3	1.1	1.0	0.8	0.5	0.4	0.2	0.1
45	3.9	3.7	3.2	3.0	2.7	2.2	2.0	1.6	1.4	1.2	1.0	0.8	0.5	0.4	0.2	0.1
46	3.9	3.7	3.3	3.1	2.7	2.3	2.1	1.6	1.4	1.2	1.0	0.8	0.5	0.4	0.2	0.1
47	4.0	3.8	3.4	3.1	2.8	2.3	2.1	1.7	1.4	1.2	1.1	0.8	0.6	0.4	0.2	0.1
48	4.1	3.9	3.4	3.2	2.9	2.4	2.1	1.7	1.4	1.2	1.1	0.9	0.6	0.4	0.2	0.1
49	4.2	4.0	3.5	3.2	2.9	2.4	2.2	1.7	1.5	1.2	1.1	0.9	0.6	0.4	0.2	0.1
50	4.2	4.0	3.6	3.3	3.0	2.5	2.2	1.8	1.5	1.3	1.1	0.9	0.6	0.4	0.2	0.1
51	4.3	4.1	3.6	3.4	3.0	2.5	2.3	1.8	1.5	1.3	1.2	0.9	0.6	0.5	0.2	0.1
52	4.4	4.2	3.7	3.4	3.1	2.6	2.3	1.9	1.6	1.3	1.2	0.9	0.6	0.5	0.2	0.1
53	4.5	4.3	3.8	3.5	3.2	2.6	2.4	1.9	1.6	1.4	1.2	1.0	0.6	0.5	0.2	0.1
54	4.6	4.4	3.9	3.6	3.2	2.7	2.4	1.9	1.6	1.4	1.2	1.0	0.6	0.5	0.2	0.1
55	4.7	4.5	4.0	3.7	3.3	2.8	2.5	2.0	1.7	1.4	1.2	1.0	0.7	0.5	0.2	0.1
56	4.9	4.6	4.1	3.8	3.4	2.8	2.6	2.0	1.7	1.5	1.3	1.0	0.7	0.5	0.3	0.1
57	5.0	4.8	4.2	3.9	3.5	2.9	2.6	2.1	1.8	1.5	1.3	1.1	0.7	0.5	0.3	0.1
58	5.1	4.9	4.3	4.0	3.6	3.0	2.7	2.2	1.8	1.5	1.4	1.1	0.7	0.5	0.3	0.1
59	5.3	5.0	4.4	4.1	3.7	3.1	2.8	2.2	1.9	1.6	1.4	1.1	0.7	0.6	0.3	0.1
60	5.4	5.2	4.6	4.2	3.8	3.2	2.9	2.3	1.9	1.6	1.4	1.1	0.8	0.6	0.3	0.1
61	5.6	5.4	4.7	4.4	3.9	3.3	3.0	2.4	2.0	1.7	1.5	1.2	0.8	0.6	0.3	0.1
62	5.8	5.5	4.9	4.5	4.1	3.4	3.0	2.4	2.0	1.7	1.5	1.2	0.8	0.6	0.3	0.2
63	6.0	5.7	5.0	4.7	4.2	3.5	3.2	2.5	2.1	1.8	1.6	1.3	0.8	0.6	0.3	0.2
64	6.2	5.9	5.2	4.8	4.3	3.6	3.3	2.6	2.2	1.9	1.6	1.3	0.9	0.7	0.3	0.2
65	6.4	6.1	5.4	5.0	4.5	3.8	3.4	2.7	2.3	1.9	1.7	1.4	0.9	0.7	0.3	0.2
66	6.7	6.4	5.6	5.2	4.7	3.9	3.5	2.8	2.3	2.0	1.8	1.4	0.9	0.7	0.4	0.2
67	6.9	6.6	5.8	5.4	4.9	4.1	3.7	2.9	2.4	2.1	1.8	1.5	1.0	0.7	0.4	0.2
68	7.2	6.9	6.1	5.6	5.1	4.2	3.8	3.1	2.5	2.2	1.9	1.5	1.0	0.8	0.4	0.2
69	7.6	7.2	6.4	5.9	5.3	4.4	4.0	3.2	2.7	2.3	2.0	1.6	1.1	0.8	0.4	0.2
70	7.9	7.6	6.7	6.2	5.6	4.6	4.2	3.4	2.8	2.4	2.1	1.7	1.1	0.8	0.4	0.2
71	8.3	7.9	7.0	6.5	5.9	4.9	4.4	3.5	2.9	2.5	2.2	1.8	1.2	0.9	0.4	0.2
72	8.8	8.4	7.4	6.8	6.2	5.1	4.6	3.7	3.1	2.6	2.3	1.9	1.2	0.9	0.5	0.2
73	9.3	8.8	7.8	7.3	6.5	5.4	4.9	3.9	3.3	2.8	2.4	2.0	1.3	1.0	0.5	0.2
74	9.8	9.4	8.3	7.7	6.9	5.8	5.2	4.2	3.5	3.0	2.6	2.1	1.4	1.0	0.5	0.3
75	10.4	10.0	8.8	8.1	7.3	6.1	5.5	4.4	3.7	3.2	2.8	2.2	1.5	1.1	0.6	0.3

Natural Trigonometric Functions

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0°→ ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	←179° ↓
0	0.00000	29	∞	—	0.00000	29	∞	—	1.00000	0	1.00000	0	60
1	.00029	29	3437.75	1718.88	.00029	29	3437.75	1718.88	.00000	0	.00000	0	59
2	.00058	29	1718.87	572.95	.00058	29	1718.87	572.95	.00000	0	.00000	0	58
3	.00087	29	1145.92	286.483	.00087	29	1145.92	286.484	.00000	0	.00000	0	57
4	.00116	29	859.437	171.887	.00116	29	859.436	171.887	.00000	0	.00000	0	56
5	.00145	30	687.550	114.592	.00145	30	687.549	114.592	1.00000	0	1.00000	0	55
6	.00175	29	572.958	81.851	.00175	29	572.957	81.851	.00000	0	.00000	0	54
7	.00204	29	491.107	61.388	.00204	29	491.106	61.388	.00000	0	.00000	0	53
8	.00233	29	429.719	47.747	.00233	29	429.718	47.747	.00000	0	.00000	0	52
9	.00262	29	381.972	38.197	.00262	29	381.971	38.197	.00000	0	.00000	0	51
10	.00291	29	343.775	31.252	.00291	29	343.774	31.253	1.00000	1	1.00000	1	50
11	.00320	29	312.523	26.044	.00320	29	312.521	26.043	.00001	0	.99999	0	49
12	.00349	29	286.479	22.036	.00349	29	286.478	22.037	.00001	0	.99999	0	48
13	.00378	29	264.443	18.889	.00378	29	264.441	18.889	.00001	0	.99999	0	47
14	.00407	29	245.554	16.370	.00407	29	245.552	16.370	.00001	0	.99999	0	46
15	.00436	29	229.184	14.324	.00436	29	229.182	14.324	1.00001	0	.99999	0	45
16	.00465	30	214.860	12.639	.00465	30	214.858	12.639	.00001	0	.99999	0	44
17	.00495	29	202.221	11.234	.00495	29	202.219	11.235	.00001	0	.99999	0	43
18	.00524	29	190.987	10.052	.00524	29	190.984	10.052	.00001	1	.99999	1	42
19	.00553	29	180.935	9.047	.00553	29	180.932	9.047	.00002	0	.99998	0	41
20	.00582	29	171.888	8.185	.00582	29	171.885	8.185	1.00002	0	.99998	0	40
21	.00611	29	163.703	7.441	.00611	29	163.700	7.441	.00002	0	.99998	0	39
22	.00640	29	156.262	6.794	.00640	29	156.259	6.794	.00002	0	.99998	0	38
23	.00669	29	149.468	6.227	.00669	29	149.465	6.228	.00002	0	.99998	0	37
24	.00698	29	143.241	5.730	.00698	29	143.237	5.730	.00002	1	.99998	1	36
25	.00727	29	137.511	5.289	.00727	29	137.507	5.288	1.00003	0	.99997	0	35
26	.00756	29	132.222	4.897	.00756	29	132.219	4.898	.00003	0	.99997	0	34
27	.00785	29	127.325	4.547	.00785	30	127.321	4.547	.00003	0	.99997	0	33
28	.00814	30	122.778	4.234	.00815	29	122.774	4.234	.00003	1	.99997	1	32
29	.00844	29	118.544	3.951	.00844	29	118.540	3.951	.00004	0	.99996	0	31
30	.00873	29	114.593	3.696	.00873	29	114.589	3.697	1.00004	0	.99996	0	30
31	.00902	29	110.897	3.466	.00902	29	110.892	3.466	.00004	0	.99996	0	29
32	.00931	29	107.431	3.255	.00931	29	107.426	3.255	.00004	1	.99996	1	28
33	.00960	29	104.176	3.064	.00960	29	104.171	3.064	.00005	0	.99995	0	27
34	.00989	29	101.112	2.8890	.00989	29	101.107	2.8891	.00005	0	.99995	0	26
35	.01018	29	98.2230	2.7283	.01018	29	98.2179	2.7284	1.00005	0	.99995	0	25
36	.01047	29	95.4947	2.5808	.01047	29	95.4895	2.5810	.00005	1	.99995	1	24
37	.01076	29	92.9139	2.4450	.01076	29	92.9085	2.4452	.00006	0	.99994	0	23
38	.01105	29	90.4689	2.3197	.01105	30	90.4633	2.3197	.00006	0	.99994	0	22
39	.01134	30	88.1492	2.2036	.01135	29	88.1436	2.2038	.00006	1	.99994	1	21
40	.01164	29	85.9456	2.0961	.01164	29	85.9398	2.0963	1.00007	0	.99993	0	20
41	.01193	29	83.8495	1.9963	.01193	29	83.8435	1.9965	.00007	0	.99993	0	19
42	.01222	29	81.8532	1.9035	.01222	29	81.8470	1.9036	.00007	1	.99993	1	18
43	.01251	29	79.9497	1.8170	.01251	29	79.9434	1.8171	.00008	0	.99992	0	17
44	.01280	29	78.1327	1.7361	.01280	29	78.1263	1.7363	.00008	1	.99992	1	16
45	.01309	29	76.3966	1.6607	.01309	29	76.3900	1.6608	1.00009	0	.99991	0	15
46	.01338	29	74.7359	1.5901	.01338	29	74.7292	1.5902	.00009	0	.99991	0	14
47	.01367	29	73.1458	1.5237	.01367	29	73.1390	1.5239	.00009	1	.99991	1	13
48	.01396	29	71.6221	1.4616	.01396	29	71.6151	1.4618	.00010	0	.99990	0	12
49	.01425	29	70.1605	1.4031	.01425	30	70.1533	1.4032	.00010	1	.99990	1	11
50	.01454	29	68.7574	1.3481	.01455	29	68.7501	1.3482	1.00011	0	.99989	0	10
51	.01483	30	67.4093	1.2963	.01484	29	67.4019	1.2964	.00011	0	.99989	0	9
52	.01513	29	66.1130	1.2473	.01513	29	66.1055	1.2475	.00011	1	.99989	1	8
53	.01542	29	64.8657	1.2011	.01542	29	64.8580	1.2013	.00012	0	.99988	0	7
54	.01571	29	63.6616	1.1574	.01571	29	63.6567	1.1575	.00012	1	.99988	1	6
55	.01600	29	62.5072	1.1161	.01600	29	62.4992	1.1163	1.00013	0	.99987	0	5
56	.01629	29	61.3911	1.0770	.01629	29	61.3829	1.0771	.00013	1	.99987	1	4
57	.01658	29	60.3141	1.0398	.01658	29	60.3058	1.0399	.00014	0	.99986	0	3
58	.01687	29	59.2743	1.0045	.01687	29	59.2659	1.0047	.00014	1	.99986	1	2
59	.01716	29	58.2698	0.9711	.01716	30	58.2612	0.9712	.00015	0	.99985	0	1
60	.01745	29	57.2987	0.9400	.01746	30	57.2900	0.9400	1.00015	0	.99985	0	0
↑90°	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'←89°	↑

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Natural Trigonometric Functions

1° → ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	← 178° ↓
0	0.01745	29	57.2987	9392	0.01746	29	57.2900	9394	1.00015	1	0.99985	1	60
1	.01774	29	56.3595	9090	.01775	29	56.3506	9091	.00016	0	.99984	0	59
2	.01803	29	55.4505	8800	.01804	29	55.4415	8802	.00016	1	.99984	1	58
3	.01832	29	54.5705	8526	.01833	29	54.5613	8527	.00017	0	.99983	0	57
4	.01862	29	53.7179	8263	.01862	29	53.7086	8265	.00017	1	.99983	1	56
5	0.01891	29	52.8916	8013	0.01891	29	52.8821	8014	1.00018	0	0.99982	0	55
6	.01920	29	52.0903	7774	.01920	29	52.0807	7775	.00018	1	.99982	1	54
7	.01949	29	51.3129	7545	.01949	29	51.3032	7547	.00019	0	.99981	0	53
8	.01978	29	50.5584	7326	.01978	29	50.5485	7328	.00020	1	.99980	1	52
9	.02007	29	49.8258	7117	.02007	29	49.8157	7118	.00020	0	.99980	0	51
10	0.02036	29	49.1141	6917	0.02036	30	49.1039	6918	1.00021	1	0.99979	1	50
11	.02065	29	48.4224	6724	.02066	29	48.4121	6726	.00021	0	.99979	0	49
12	.02094	29	47.7500	6540	.02095	29	47.7395	6542	.00022	1	.99978	1	48
13	.02123	29	47.0960	6364	.02124	29	47.0853	6364	.00023	0	.99977	0	47
14	.02152	29	46.4596	6193	.02153	29	46.4489	6195	.00023	1	.99977	1	46
15	0.02181	30	45.8403	6031	0.02182	29	45.8294	6033	1.00024	0	0.99976	0	45
16	.02211	29	45.2372	5874	.02211	29	45.2261	5875	.00024	1	.99976	1	44
17	.02240	29	44.6498	5723	.02240	29	44.6386	5725	.00025	0	.99975	0	43
18	.02269	29	44.0775	5579	.02269	29	44.0661	5580	.00026	1	.99974	1	42
19	.02298	29	43.5196	5439	.02298	30	43.5081	5440	.00026	0	.99974	0	41
20	0.02327	29	42.9757	5305	0.02328	29	42.9641	5306	1.00027	1	0.99973	1	40
21	.02356	29	42.4452	5175	.02357	29	42.4335	5177	.00028	0	.99972	0	39
22	.02385	29	41.9277	5050	.02386	29	41.9158	5052	.00028	1	.99972	1	38
23	.02414	29	41.4227	4931	.02415	29	41.4106	4932	.00029	0	.99971	0	37
24	.02443	29	40.9296	4814	.02444	29	40.9174	4816	.00030	1	.99970	1	36
25	0.02472	29	40.4482	4702	0.02473	29	40.4358	4703	1.00031	0	0.99969	0	35
26	.02501	29	39.9780	4595	.02502	29	39.9655	4596	.00031	1	.99969	1	34
27	.02530	29	39.5185	4489	.02531	29	39.5059	4491	.00032	0	.99968	0	33
28	.02560	30	39.0696	4389	.02560	29	39.0568	4391	.00033	1	.99967	1	32
29	.02589	29	38.6307	4291	.02589	30	38.6177	4292	.00034	0	.99966	0	31
30	0.02618	29	38.2016	4198	0.02619	29	38.1885	4199	1.00034	1	0.99966	1	30
31	.02647	29	37.7818	4105	.02648	29	37.7686	4107	.00035	0	.99965	0	29
32	.02676	29	37.3713	4018	.02677	29	37.3579	4019	.00036	1	.99964	1	28
33	.02705	29	36.9695	3932	.02706	29	36.9560	3933	.00037	0	.99963	0	27
34	.02734	29	36.5763	3849	.02735	29	36.5627	3851	.00037	1	.99963	1	26
35	0.02763	29	36.1914	3769	0.02764	29	36.1776	3770	1.00038	0	0.99962	0	25
36	.02792	29	35.8145	3691	.02793	29	35.8006	3693	.00039	1	.99961	1	24
37	.02821	29	35.4454	3616	.02822	29	35.4313	3618	.00040	0	.99960	0	23
38	.02850	29	35.0838	3543	.02851	30	35.0695	3544	.00041	1	.99959	1	22
39	.02879	29	34.7295	3472	.02881	29	34.7151	3473	.00041	0	.99959	0	21
40	0.02908	30	34.3823	3403	0.02910	29	34.3678	3405	1.00042	1	0.99958	1	20
41	.02938	29	34.0420	3337	.02939	29	34.0273	3338	.00043	0	.99957	0	19
42	.02967	29	33.7083	3271	.02968	29	33.6935	3273	.00044	1	.99956	1	18
43	.02996	29	33.3812	3209	.02997	29	33.3662	3210	.00045	0	.99955	0	17
44	.03025	29	33.0603	3148	.03026	29	33.0452	3149	.00046	1	.99954	1	16
45	0.03054	29	32.7455	3088	0.03055	29	32.7303	3090	1.00047	0	0.99953	0	15
46	.03083	29	32.4367	3030	.03084	30	32.4213	3032	.00048	1	.99952	1	14
47	.03112	29	32.1337	2975	.03114	29	32.1181	2976	.00048	0	.99952	0	13
48	.03141	29	31.8362	2920	.03143	29	31.8205	2921	.00049	1	.99951	1	12
49	.03170	29	31.5442	2866	.03172	29	31.5284	2868	.00050	0	.99950	0	11
50	0.03199	29	31.2576	2815	0.03201	29	31.2416	2817	1.00051	1	0.99949	1	10
51	.03228	29	30.9761	2765	.03230	29	30.9599	2766	.00052	0	.99948	0	9
52	.03257	29	30.6996	2716	.03259	29	30.6833	2717	.00053	1	.99947	1	8
53	.03286	30	30.4280	2668	.03288	29	30.4116	2670	.00054	0	.99946	0	7
54	.03316	29	30.1612	2622	.03317	29	30.1446	2623	.00055	1	.99945	1	6
55	0.03345	29	29.8990	2576	0.03346	30	29.8823	2578	1.00056	0	0.99944	0	5
56	.03374	29	29.6414	2533	.03376	29	29.6245	2534	.00057	1	.99943	1	4
57	.03403	29	29.3881	2489	.03405	29	29.3711	2491	.00058	0	.99942	0	3
58	.03432	29	29.1392	2448	.03434	29	29.1220	2449	.00059	1	.99941	1	2
59	.03461	29	28.8944	2407	.03463	29	28.8771	2408	.00060	0	.99940	0	1
60	0.03490	29	28.6537	2407	0.03492	29	28.6363	2408	1.00061	1	0.99939	1	0
↑ 91°	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1' ←	88° ↑

Natural Trigonometric Functions

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2° →	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	← 177°
0	0.03490	29	28.6537	2367	0.03492	29	28.6363	2369	1.00061	1	0.99939	1	60
1	0.03519	29	4170	2328	0.03521	29	3994	2330	0.00062	1	0.99938	1	59
2	0.03548	29	28.1842	2291	0.03550	29	28.1664	2292	0.00063	1	0.99937	1	58
3	0.03577	29	27.9551	2253	0.03579	30	27.9372	2255	0.00064	1	0.99936	1	57
4	0.03606	29	7298	2218	0.03609	29	7117	2218	0.00065	1	0.99935	1	56
5	0.03635	29	27.5080	2182	0.03638	29	27.4899	2184	1.00066	1	0.99934	1	55
6	0.03664	29	2898	2148	0.03667	29	27.15	2149	0.00067	1	0.99933	1	54
7	0.03693	30	27.0750	2114	0.03696	29	27.0566	2116	0.00068	1	0.99932	1	53
8	0.03723	29	26.8636	2081	0.03725	29	26.8450	2083	0.00069	1	0.99931	1	52
9	0.03752	29	6555	2050	0.03754	29	6367	2051	0.00070	2	0.99930	1	51
10	0.03781	29	26.4505	2018	0.03783	29	26.4316	2020	1.00072	1	0.99929	2	50
11	0.03810	29	2487	1988	0.03812	30	2296	1989	0.00073	1	0.99927	1	49
12	0.03839	29	26.0499	1957	0.03842	29	26.0307	1959	0.00074	1	0.99926	1	48
13	0.03868	29	25.8542	1929	0.03871	29	25.8348	1930	0.00075	1	0.99925	1	47
14	0.03897	29	6613	1900	0.03900	29	6418	1901	0.00076	1	0.99924	1	46
15	0.03926	29	25.4713	1872	0.03929	29	25.4517	1873	1.00077	1	0.99923	1	45
16	0.03955	29	2841	1844	0.03958	29	2644	1846	0.00078	1	0.99922	1	44
17	0.03984	29	25.0997	1818	0.03987	29	25.0798	1820	0.00079	2	0.99921	2	43
18	0.04013	29	24.9179	1792	0.04016	30	24.8978	1793	0.00081	1	0.99919	1	42
19	0.04042	29	7387	1766	0.04046	29	7185	1767	0.00082	1	0.99918	1	41
20	0.04071	29	24.5621	1741	0.04075	29	24.5418	1743	1.00083	1	0.99917	1	40
21	0.04100	29	3880	1716	0.04104	29	3675	1718	0.00084	1	0.99916	1	39
22	0.04129	30	2164	1693	0.04133	29	1957	1718	0.00085	2	0.99915	2	38
23	0.04159	29	24.0471	1669	0.04162	29	24.0263	1694	0.00087	1	0.99913	1	37
24	0.04188	29	23.8802	1646	0.04191	29	23.8593	1648	0.00088	1	0.99912	1	36
25	0.04217	29	23.7156	1623	0.04220	30	23.6945	1624	1.00089	1	0.99911	1	35
26	0.04246	29	5533	1601	0.04250	29	5321	1603	0.00090	1	0.99910	1	34
27	0.04275	29	3932	1580	0.04279	29	3718	1603	0.00091	2	0.99909	2	33
28	0.04304	29	2352	1558	0.04308	29	2137	1581	0.00093	1	0.99907	1	32
29	0.04333	29	23.0794	1538	0.04337	29	23.0577	1539	0.00094	1	0.99906	1	31
30	0.04362	29	22.9256	1517	0.04366	29	22.9038	1519	1.00095	2	0.99905	1	30
31	0.04391	29	7739	1498	0.04395	29	7519	1499	0.00097	1	0.99904	1	29
32	0.04420	29	6241	1477	0.04424	30	6020	1499	0.00098	1	0.99902	2	28
33	0.04449	29	4764	1459	0.04454	29	4541	1479	0.00099	1	0.99901	1	27
34	0.04478	29	3305	1440	0.04483	29	3081	1460	0.0100	2	0.99900	2	26
35	0.04507	29	22.1865	1421	0.04512	29	22.1640	1423	1.00102	1	0.99898	1	25
36	0.04536	29	22.0444	1403	0.04541	29	22.0217	1404	0.00103	1	0.99897	1	24
37	0.04565	29	21.9041	1385	0.04570	29	21.8813	1404	0.00104	2	0.99896	1	23
38	0.04594	29	7656	1368	0.04599	29	7426	1387	0.00106	1	0.99894	2	22
39	0.04623	30	6288	1351	0.04628	30	6056	1370	0.00107	1	0.99893	1	21
40	0.04653	29	21.4937	1334	0.04658	29	21.4704	1335	1.00108	2	0.99892	2	20
41	0.04682	29	3603	1318	0.04687	29	3369	1320	0.00110	1	0.99890	1	19
42	0.04711	29	2285	1301	0.04716	29	2049	1302	0.00111	2	0.99889	1	18
43	0.04740	29	21.0984	1286	0.04745	29	21.0747	1287	0.00113	1	0.99888	2	17
44	0.04769	29	20.9698	1270	0.04774	29	20.9460	1272	0.00114	1	0.99886	1	16
45	0.04798	29	20.8428	1254	0.04803	30	20.8188	1256	1.00115	2	0.99885	2	15
46	0.04827	29	7174	1240	0.04833	29	6932	1241	0.00117	1	0.99883	1	14
47	0.04856	29	5934	1225	0.04862	29	5691	1226	0.00118	2	0.99882	1	13
48	0.04885	29	4709	1210	0.04891	29	4465	1212	0.00120	1	0.99881	1	12
49	0.04914	29	3499	1196	0.04920	29	3253	1197	0.00121	1	0.99879	1	11
50	0.04943	29	20.2303	1182	0.04949	29	20.2056	1184	1.00122	2	0.99878	2	10
51	0.04972	29	20.1121	1169	0.04978	29	20.0872	1170	0.00124	1	0.99876	1	9
52	0.05001	29	19.9952	1154	0.05007	30	19.9702	1156	0.00125	2	0.99875	2	8
53	0.05030	29	8798	1142	0.05037	29	8546	1143	0.00127	1	0.99873	1	7
54	0.05059	29	7656	1128	0.05066	29	7403	1130	0.00128	2	0.99872	2	6
55	0.05088	29	19.6528	1116	0.05095	29	19.6273	1117	1.00130	1	0.99870	1	5
56	0.05117	29	5412	1103	0.05124	29	5156	1105	0.00131	2	0.99869	2	4
57	0.05146	29	4309	1091	0.05153	29	4051	1092	0.00133	1	0.99867	1	3
58	0.05175	30	3218	1078	0.05182	30	2959	1080	0.00134	2	0.99866	2	2
59	0.05205	29	2140	1067	0.05212	29	1879	1068	0.00136	1	0.99864	1	1
60	0.05234	29	19.1073	1067	0.05241	29	19.0811	1068	1.00137	1	0.99863	1	0
↑ 92°	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	↑ 87°

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Natural Trigonometric Functions

$3^\circ \rightarrow$ ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	$\leftarrow 176^\circ$ ↑
0	0.05234	29	19.1073	1054	0.05241	29	19.0811	1056	1.00137	2	0.99863	2	60
1	0.05263	29	19.0019	1044	0.05270	29	18.9755	1044	0.00139	1	0.99861	1	59
2	0.05292	29	18.8975	1031	0.05299	29	8711	1033	0.00140	2	0.99860	2	58
3	0.05321	29	7944	1021	0.05328	29	7678	1022	0.00142	2	0.99858	2	57
4	0.05350	29	6923	1009	0.05357	30	6656	1011	0.00143	2	0.99857	2	56
5	0.05379	29	5914	999	0.05387	29	5645	1000	1.00145	2	0.99855	2	55
6	0.05408	29	4915	988	0.05416	29	4645	990	0.00147	1	0.99854	1	54
7	0.05437	29	3927	977	0.05445	29	3655	978	0.00148	2	0.99852	2	53
8	0.05466	29	2950	967	0.05474	29	2677	969	0.00150	1	0.99851	1	52
9	0.05495	29	1983	957	0.05503	30	1708	958	0.00151	2	0.99849	2	51
10	0.05524	29	1026	947	0.05533	29	0750	948	1.00153	2	0.99847	2	50
11	0.05553	29	0079	937	0.05562	29	9802	939	0.00155	1	0.99846	1	49
12	0.05582	29	9142	927	0.05591	29	8863	929	0.00156	2	0.99844	2	48
13	0.05611	29	8215	917	0.05620	29	7934	919	0.00158	1	0.99842	1	47
14	0.05640	29	7298	909	0.05649	29	7015	909	0.00159	2	0.99841	2	46
15	0.05669	29	6389	899	0.05678	30	6106	901	1.00161	2	0.99839	2	45
16	0.05698	29	5490	890	0.05708	29	5205	891	0.00163	1	0.99838	1	44
17	0.05727	29	4600	880	0.05737	29	4314	882	0.00164	2	0.99836	2	43
18	0.05756	29	3720	872	0.05766	29	3432	874	0.00166	2	0.99834	2	42
19	0.05785	29	2848	864	0.05795	29	2558	865	0.00168	1	0.99833	1	41
20	0.05814	30	1984	854	0.05824	30	17.1693	856	1.00169	2	0.99831	2	40
21	0.05844	29	1130	847	0.05854	29	0837	847	0.00171	2	0.99829	2	39
22	0.05873	29	0283	837	0.05883	29	9990	840	0.00173	2	0.99827	2	38
23	0.05902	29	9446	830	0.05912	29	9150	831	0.00175	1	0.99826	1	37
24	0.05931	29	8616	822	0.05941	29	8319	823	0.00176	2	0.99824	2	36
25	0.05960	29	7794	813	0.05970	29	7496	815	1.00178	2	0.99822	2	35
26	0.05989	29	6981	806	0.05999	30	6681	807	0.00180	2	0.99821	2	34
27	0.06018	29	6175	806	0.06029	29	5874	807	0.00182	1	0.99819	1	33
28	0.06047	29	5377	798	0.06058	29	5075	799	0.00183	2	0.99817	2	32
29	0.06076	29	4587	790	0.06087	29	4283	792	0.00185	2	0.99815	2	31
30	0.06105	29	3804	783	0.06116	29	3499	784	1.00187	2	0.99813	2	30
31	0.06134	29	3029	775	0.06145	29	2722	777	0.00189	2	0.99812	2	29
32	0.06163	29	2261	768	0.06175	30	1952	770	0.00190	1	0.99810	1	28
33	0.06192	29	1500	761	0.06204	29	1190	762	0.00192	2	0.99808	2	27
34	0.06221	29	0746	754	0.06233	29	0435	755	0.00194	2	0.99806	2	26
35	0.06250	29	9999	747	0.06262	29	9687	748	1.00196	2	0.99804	2	25
36	0.06279	29	9260	739	0.06291	29	8945	742	0.00198	2	0.99803	2	24
37	0.06308	29	8527	733	0.06321	30	8211	734	0.00200	2	0.99801	2	23
38	0.06337	29	7801	726	0.06350	29	7483	728	0.00201	1	0.99799	1	22
39	0.06366	29	7081	720	0.06379	29	6762	721	0.00203	2	0.99797	2	21
40	0.06395	29	6368	713	0.06408	29	6048	714	1.00205	2	0.99795	2	20
41	0.06424	29	5661	707	0.06438	30	5340	708	0.00207	2	0.99793	2	19
42	0.06453	29	4961	700	0.06467	29	4638	702	0.00209	2	0.99792	2	18
43	0.06482	29	4267	694	0.06496	29	3943	695	0.00211	2	0.99790	2	17
44	0.06511	29	3579	688	0.06525	29	3254	689	0.00213	2	0.99788	2	16
45	0.06540	29	2898	681	0.06554	29	2571	683	1.00215	2	0.99786	2	15
46	0.06569	29	2222	676	0.06584	30	1893	678	0.00216	1	0.99784	1	14
47	0.06598	29	1553	669	0.06613	29	1222	671	0.00218	2	0.99782	2	13
48	0.06627	29	0889	664	0.06642	29	0557	665	0.00220	2	0.99780	2	12
49	0.06656	29	0231	658	0.06671	29	9898	659	0.00222	2	0.99778	2	11
50	0.06685	29	9579	652	0.06700	29	9244	654	1.00224	2	0.99776	2	10
51	0.06714	29	8932	647	0.06730	30	8596	648	0.00226	2	0.99774	2	9
52	0.06743	29	8291	641	0.06759	29	7954	642	0.00228	2	0.99772	2	8
53	0.06773	30	7656	635	0.06788	29	7317	637	0.00230	2	0.99770	2	7
54	0.06802	29	7028	630	0.06817	29	6685	632	0.00232	2	0.99768	2	6
55	0.06831	29	6401	625	0.06847	30	6059	626	1.00234	2	0.99766	2	5
56	0.06860	29	5782	619	0.06876	29	5438	621	0.00236	2	0.99764	2	4
57	0.06889	29	5168	614	0.06905	29	4823	615	0.00238	2	0.99762	2	3
58	0.06918	29	4559	609	0.06934	29	4212	611	0.00240	2	0.99760	2	2
59	0.06947	29	3955	604	0.06963	29	3607	605	0.00242	2	0.99758	2	1
60	0.06976	29	3356	599	0.06993	30	3007	600	1.00244	2	0.99756	2	0
$\uparrow 93^\circ$	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	$\uparrow 86^\circ$

Natural Trigonometric Functions

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4°→ ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	↑175° ↓
0	0.06976	29	14.3356	594	0.06993	29	14.3007	596	1.00244	2	0.99756	2	60
1	0.07005	29	2762	589	0.07022	29	2411	590	0.00246	2	0.99754	2	59
2	0.07034	29	2173	584	0.07051	29	1821	586	0.00248	2	0.99752	2	58
3	0.07063	29	1589	579	0.07080	30	1235	580	0.00250	2	0.99750	2	57
4	0.07092	29	1010	575	0.07110	29	0655	576	0.00252	2	0.99748	2	56
5	0.07121	29	14.0435	570	0.07139	29	14.0079	572	1.00254	3	0.99746	2	55
6	0.07150	29	13.9865	565	0.07168	29	13.9507	567	0.00257	2	0.99744	2	54
7	0.07179	29	9300	561	0.07197	30	8940	562	0.00259	2	0.99742	2	53
8	0.07208	29	8739	556	0.07227	29	8378	557	0.00261	2	0.99740	2	52
9	0.07237	29	8183	552	0.07256	29	7821	554	0.00263	2	0.99738	2	51
10	0.07266	29	13.7631	547	0.07285	29	13.7267	548	1.00265	2	0.99736	2	50
11	0.07295	29	7084	543	0.07314	30	6719	545	0.00267	2	0.99734	3	49
12	0.07324	29	6541	539	0.07344	29	6174	540	0.00269	2	0.99731	2	48
13	0.07353	29	6002	534	0.07373	29	5634	536	0.00271	3	0.99729	2	47
14	0.07382	29	5468	531	0.07402	29	5098	532	0.00274	2	0.99727	2	46
15	0.07411	29	13.4937	526	0.07431	30	13.4566	527	1.00276	2	0.99725	2	45
16	0.07440	29	4411	522	0.07461	29	4039	524	0.00278	2	0.99723	2	44
17	0.07469	29	3889	518	0.07490	29	3515	519	0.00280	2	0.99721	2	43
18	0.07498	29	3371	514	0.07519	29	2996	516	0.00282	2	0.99719	3	42
19	0.07527	29	2857	510	0.07548	30	2480	511	0.00284	3	0.99716	2	41
20	0.07556	29	13.2347	506	0.07578	29	13.1969	508	1.00287	2	0.99714	2	40
21	0.07585	29	1841	502	0.07607	29	1461	503	0.00289	2	0.99712	2	39
22	0.07614	29	1339	499	0.07636	29	0958	500	0.00291	2	0.99710	2	38
23	0.07643	29	0840	494	0.07665	30	13.0458	496	0.00293	3	0.99708	3	37
24	0.07672	29	13.0346	491	0.07695	29	12.9962	493	0.00296	2	0.99705	2	36
25	0.07701	29	12.9855	487	0.07724	29	12.9469	488	1.00298	2	0.99703	2	35
26	0.07730	29	9368	484	0.07753	29	8981	485	0.00300	2	0.99701	2	34
27	0.07759	29	8884	480	0.07782	29	8496	482	0.00302	3	0.99699	3	33
28	0.07788	29	8404	476	0.07812	30	8014	478	0.00305	2	0.99696	2	32
29	0.07817	29	7928	473	0.07841	29	7536	474	0.00307	2	0.99694	2	31
30	0.07846	29	12.7455	469	0.07870	29	12.7062	471	1.00309	3	0.99692	3	30
31	0.07875	29	6986	466	0.07899	30	6591	467	0.00312	2	0.99689	2	29
32	0.07904	29	6520	463	0.07929	29	6124	464	0.00314	2	0.99687	2	28
33	0.07933	29	6057	459	0.07958	29	5660	461	0.00316	2	0.99685	2	27
34	0.07962	29	5598	456	0.07987	30	5199	457	0.00318	3	0.99683	3	26
35	0.07991	29	12.5142	452	0.08017	29	12.4742	454	1.00321	2	0.99680	2	25
36	0.08020	29	4690	449	0.08046	29	4288	450	0.00323	3	0.99678	2	24
37	0.08049	29	4241	446	0.08075	29	3838	448	0.00326	2	0.99676	3	23
38	0.08078	29	3795	443	0.08104	30	3390	444	0.00328	2	0.99673	2	22
39	0.08107	29	3352	439	0.08134	29	2946	441	0.00330	3	0.99671	3	21
40	0.08136	29	12.2913	437	0.08163	29	12.2505	438	1.00333	2	0.99668	2	20
41	0.08165	29	2476	433	0.08192	29	2067	435	0.00335	2	0.99666	2	19
42	0.08194	29	2043	431	0.08221	30	1632	431	0.00337	3	0.99664	3	18
43	0.08223	29	1612	427	0.08251	29	1201	429	0.00340	2	0.99661	2	17
44	0.08252	29	1185	424	0.08280	29	0772	426	0.00342	3	0.99659	2	16
45	0.08281	29	12.0761	421	0.08309	30	12.0346	423	1.00345	2	0.99657	3	15
46	0.08310	29	12.0340	419	0.08339	29	11.9923	419	0.00347	3	0.99654	2	14
47	0.08339	29	11.9921	415	0.08368	29	9504	417	0.00350	2	0.99652	2	13
48	0.08368	29	9506	413	0.08397	30	9087	414	0.00352	2	0.99649	2	12
49	0.08397	29	9093	409	0.08427	29	8673	411	0.00354	3	0.99647	3	11
50	0.08426	29	11.8684	407	0.08456	29	11.8262	409	1.00357	2	0.99644	2	10
51	0.08455	29	8277	404	0.08485	29	7853	405	0.00359	3	0.99642	3	9
52	0.08484	29	7873	402	0.08514	30	7448	403	0.00362	2	0.99639	2	8
53	0.08513	29	7471	398	0.08544	29	7045	400	0.00364	3	0.99637	2	7
54	0.08542	29	7073	396	0.08573	29	6645	397	0.00367	2	0.99635	3	6
55	0.08571	29	11.6677	393	0.08602	30	11.6248	395	1.00369	3	0.99632	2	5
56	0.08600	29	6284	391	0.08632	29	5853	392	0.00372	2	0.99630	3	4
57	0.08629	29	5893	388	0.08661	29	5461	389	0.00374	3	0.99627	2	3
58	0.08658	29	5505	385	0.08690	30	5072	387	0.00377	2	0.99625	3	2
59	0.08687	29	5120	383	0.08720	29	4685	384	0.00379	3	0.99622	3	1
60	0.08716	29	11.4737		0.08749	29	11.4301		1.00382		0.99619		0
↑94°	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	↑85°

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Natural Trigonometric Functions

5° ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	174° ↑
0	0.08716	29	11.4737	380	0.08749	29	11.4301	382	1.00382	3	0.99619	2	60
1	0.08745	29	4357	378	0.08778	29	3919	379	0.00385	2	99617	3	59
2	0.08774	29	3979	375	0.08807	30	3540	377	0.00387	3	99614	2	58
3	0.08803	28	3604	373	0.08837	29	3163	374	0.00390	2	99612	3	57
4	0.08831	29	3231	370	0.08866	29	2789	372	0.00392	3	99609	2	56
5	0.08860	29	2861	368	0.08895	30	2417	369	1.00395	2	0.99607	3	55
6	0.08889	29	2493	365	0.08925	29	2048	367	0.00397	3	99604	2	54
7	0.08918	29	2128	363	0.08954	29	1681	365	0.00400	3	99602	3	53
8	0.08947	29	1765	361	0.08983	30	1316	362	0.00403	2	99599	3	52
9	0.08976	29	1404	359	0.09013	29	0954	360	0.00405	3	99596	2	51
10	0.09005	29	11.1045	356	0.09042	29	11.0594	357	1.00408	3	0.99594	3	50
11	0.09034	29	0689	353	0.09071	30	11.0237	355	0.00411	2	99591	3	49
12	0.09063	29	11.0336	352	0.09101	29	10.9882	353	0.00413	3	99588	2	48
13	0.09092	29	10.9984	349	0.09130	29	9529	351	0.00416	3	99586	3	47
14	0.09121	29	9635	347	0.09159	30	9178	349	0.00419	2	99583	3	46
15	0.09150	29	10.9288	345	0.09189	29	10.8829	346	1.00421	3	0.99580	2	45
16	0.09179	29	8943	343	0.09218	29	8483	344	0.00424	3	99578	3	44
17	0.09208	29	8600	340	0.09247	30	8139	342	0.00427	2	99575	3	43
18	0.09237	29	8260	339	0.09277	29	7797	340	0.00429	3	99572	2	42
19	0.09266	29	7921	336	0.09306	29	7457	338	0.00432	3	99570	3	41
20	0.09295	29	10.7585	334	0.09335	30	10.7119	336	1.00435	3	0.99567	3	40
21	0.09324	29	7251	332	0.09365	29	6783	333	0.00438	2	99564	2	39
22	0.09353	29	6919	330	0.09394	29	6450	332	0.00440	3	99562	3	38
23	0.09382	29	6589	328	0.09423	30	6118	329	0.00443	3	99559	3	37
24	0.09411	29	6261	326	0.09453	29	5789	327	0.00446	3	99556	3	36
25	0.09440	29	10.5935	324	0.09482	29	10.5462	326	1.00449	2	0.99553	2	35
26	0.09469	29	5611	322	0.09511	30	5136	323	0.00451	3	99551	3	34
27	0.09498	29	5289	320	0.09541	29	4813	322	0.00454	3	99548	3	33
28	0.09527	29	4969	319	0.09570	30	4491	319	0.00457	3	99545	3	32
29	0.09556	29	4650	316	0.09600	29	4172	318	0.00460	3	99542	2	31
30	0.09585	29	10.4334	314	0.09629	29	10.3854	316	1.00463	2	0.99540	3	30
31	0.09614	28	4020	312	0.09658	30	3538	314	0.00465	3	99537	3	29
32	0.09642	29	3708	311	0.09688	29	3224	311	0.00468	3	99534	3	28
33	0.09671	29	3397	308	0.09717	29	2913	311	0.00471	3	99531	3	27
34	0.09700	29	3089	307	0.09746	30	2602	308	0.00474	3	99528	2	26
35	0.09729	29	10.2782	305	0.09776	29	10.2294	306	1.00477	3	0.99526	3	25
36	0.09758	29	2477	303	0.09805	29	1988	305	0.00480	2	99523	3	24
37	0.09787	29	2174	301	0.09834	30	1683	302	0.00482	3	99520	3	23
38	0.09816	29	1873	300	0.09864	29	1381	301	0.00485	3	99517	3	22
39	0.09845	29	1573	298	0.09893	30	1080	300	0.00488	3	99514	3	21
40	0.09874	29	10.1275	296	0.09923	29	10.0780	297	1.00491	3	0.99511	3	20
41	0.09903	29	0979	294	0.09952	29	0483	296	0.00494	3	99508	2	19
42	0.09932	29	0685	293	0.09981	30	10.0187	2939	0.00497	3	99506	3	18
43	0.09961	29	0392	291	1.00011	29	9.98931	2924	0.00500	3	99503	3	17
44	0.09990	29	0101	2887	1.00040	29	96007	2906	0.00503	3	99500	3	16
45	0.10019	29	9.98123	2875	0.10069	30	9.93101	2890	1.00506	3	0.99497	3	15
46	0.10048	29	95248	2859	0.10099	29	90211	2873	0.00509	3	99494	3	14
47	0.10077	29	92389	2842	0.10128	30	87338	2856	0.00512	3	99491	3	13
48	0.10106	29	89547	2825	0.10158	29	84482	2841	0.00515	3	99488	3	12
49	0.10135	29	86722	2810	0.10187	29	81641	2824	0.00518	3	99485	3	11
50	0.10164	28	9.83912	2793	0.10216	30	9.78817	2808	1.00521	3	0.99482	3	10
51	0.10192	29	81119	2778	0.10246	29	76009	2792	0.00524	3	99479	3	9
52	0.10221	29	78341	2762	0.10275	30	73217	2776	0.00527	3	99476	3	8
53	0.10250	29	75579	2746	0.10305	29	70441	2761	0.00530	3	99473	3	7
54	0.10279	29	72833	2730	0.10334	29	67680	2745	0.00533	3	99470	3	6
55	0.10308	29	9.70103	2716	0.10363	30	9.64935	2730	1.00536	3	0.99467	3	5
56	0.10337	29	67387	2700	0.10393	29	62205	2715	0.00539	3	99464	3	4
57	0.10366	29	64687	2685	0.10422	30	59490	2699	0.00542	3	99461	3	3
58	0.10395	29	62002	2670	0.10452	29	56791	2685	0.00545	3	99458	3	2
59	0.10424	29	59332	2655	0.10481	29	54106	2670	0.00548	3	99455	3	1
60	0.10453	29	9.56677		0.10510		9.51436		1.00551		0.99452		0
95° ↑	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	84° ↑

Natural Trigonometric Functions

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6° ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	↑ 173°
0	0.10453	29	9.56677	2640	0.10510	30	9.51436	2655	1.00551	3	0.99452	3	60
1	.10482	29	.54037	2626	.10540	29	.48781	2640	.00554	3	.99449	3	59
2	.10511	29	.51411	2611	.10569	30	.46141	2626	.00557	3	.99446	3	58
3	.10540	29	.48800	2597	.10599	30	.43515	2611	.00560	3	.99443	3	57
4	.10569	28	.46203	2583	.10628	29	.40904	2597	.00563	3	.99440	3	56
5	0.10597	29	9.43620	2568	0.10657	30	9.38307	2583	1.00566	3	0.99437	3	55
6	.10626	29	.41052	2555	.10687	29	.35724	2569	.00569	4	.99434	3	54
7	.10655	29	.38497	2540	.10716	30	.33155	2556	.00573	3	.99431	3	53
8	.10684	29	.35957	2527	.10746	30	.30599	2541	.00576	3	.99428	4	52
9	.10713	29	.33430	2513	.10775	30	.28058	2528	.00579	3	.99424	3	51
10	0.10742	29	9.30917	2500	0.10805	29	9.25530	2514	1.00582	3	0.99421	3	50
11	.10771	29	.28417	2486	.10834	29	.23016	2500	.00585	3	.99418	3	49
12	.10800	29	.25931	2472	.10863	30	.20516	2488	.00588	4	.99415	3	48
13	.10829	29	.23459	2460	.10893	30	.18028	2474	.00592	3	.99412	3	47
14	.10858	29	.20999	2446	.10922	30	.15554	2461	.00595	3	.99409	3	46
15	0.10887	29	9.18553	2433	0.10952	29	9.13093	2447	1.00598	3	0.99406	4	45
16	.10916	29	.16120	2421	.10981	30	.10646	2435	.00601	3	.99402	3	44
17	.10945	28	.13699	2407	.11011	29	.08211	2422	.00604	4	.99399	3	43
18	.10973	29	.11292	2395	.11040	30	.05789	2410	.00608	3	.99396	3	42
19	.11002	29	.08897	2382	.11070	29	.03379	2396	.00611	3	.99393	3	41
20	0.11031	29	9.06515	2369	0.11099	29	9.00983	2385	1.00614	3	0.99390	4	40
21	.11060	29	.04146	2358	.11128	30	.89598	2371	.00617	4	.99386	3	39
22	.11089	29	.01788	2344	.11158	29	.86227	2360	.00621	3	.99383	3	38
23	.11118	29	.89944	2333	.11187	30	.93867	2347	.00624	3	.99380	3	37
24	.11147	29	.97111	2320	.11217	29	.91520	2335	.00627	3	.99377	3	36
25	0.11176	29	8.94791	2309	0.11246	30	8.89185	2323	1.00630	4	0.99374	4	35
26	.11205	29	.92482	2296	.11276	29	.86862	2311	.00634	3	.99370	3	34
27	.11234	29	.90186	2285	.11305	30	.84551	2299	.00637	3	.99367	3	33
28	.11263	28	.87901	2273	.11335	30	.82252	2288	.00640	4	.99364	4	32
29	.11291	29	.85628	2261	.11364	30	.79964	2275	.00644	3	.99360	3	31
30	0.11320	29	8.83367	2249	0.11394	29	8.77689	2264	1.00647	3	0.99357	3	30
31	.11349	29	.81118	2238	.11423	29	.75425	2253	.00650	4	.99354	3	29
32	.11378	29	.78880	2227	.11452	30	.73172	2241	.00654	3	.99351	4	28
33	.11407	29	.76653	2215	.11482	30	.70931	2230	.00657	3	.99347	3	27
34	.11436	29	.74438	2204	.11511	29	.68701	2219	.00660	4	.99344	3	26
35	0.11465	29	8.72234	2193	0.11541	29	8.66482	2207	1.00664	3	0.99341	4	25
36	.11494	29	.70041	2182	.11570	30	.64275	2197	.00667	4	.99337	3	24
37	.11523	29	.67859	2171	.11600	29	.62078	2185	.00671	3	.99334	3	23
38	.11552	28	.65688	2160	.11629	30	.59893	2175	.00674	3	.99331	4	22
39	.11580	29	.63528	2149	.11659	29	.57718	2163	.00677	4	.99327	3	21
40	0.11609	29	8.61379	2138	0.11688	30	8.55555	2153	1.00681	3	0.99324	4	20
41	.11638	29	.59241	2128	.11718	29	.53402	2143	.00684	4	.99320	3	19
42	.11667	29	.57113	2117	.11747	30	.51259	2131	.00688	3	.99317	3	18
43	.11696	29	.54996	2107	.11777	29	.49128	2121	.00691	4	.99314	4	17
44	.11725	29	.52889	2096	.11806	30	.47007	2111	.00695	3	.99310	3	16
45	0.11754	29	8.50793	2086	0.11836	29	8.44896	2101	1.00698	3	0.99307	4	15
46	.11783	29	.48707	2075	.11865	30	.42795	2090	.00701	4	.99303	3	14
47	.11812	28	.46632	2066	.11895	29	.40705	2080	.00705	3	.99300	3	13
48	.11840	29	.44566	2055	.11924	30	.38625	2070	.00708	4	.99297	4	12
49	.11869	29	.42511	2045	.11954	29	.36555	2059	.00712	3	.99293	3	11
50	0.11898	29	8.40466	2035	0.11983	30	8.34496	2050	1.00715	4	0.99290	4	10
51	.11927	29	.38431	2026	.12013	29	.32446	2040	.00719	3	.99286	3	9
52	.11956	29	.36405	2015	.12042	30	.30406	2030	.00722	4	.99283	4	8
53	.11985	29	.34390	2006	.12072	29	.28376	2021	.00726	4	.99279	3	7
54	.12014	29	.32384	1996	.12101	30	.26355	2010	.00730	3	.99276	4	6
55	0.12043	28	8.30388	1986	0.12131	29	8.24345	2001	1.00733	4	0.99272	3	5
56	.12071	29	.28402	1977	.12160	30	.22344	1992	.00737	3	.99269	4	4
57	.12100	29	.26425	1968	.12190	29	.20352	1982	.00740	4	.99265	3	3
58	.12129	29	.24457	1957	.12219	30	.18370	1972	.00744	3	.99262	4	2
59	.12158	29	.22500	1949	.12249	29	.16398	1963	.00747	4	.99258	3	1
60	0.12187	28	8.20551		0.12278		8.14435		1.00751		0.99255		0
↑ 96°	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	↑ 83°

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Natural Trigonometric Functions

7°→ ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	←172° ↓
0	0.12187	29	8.20551	1939	0.12278	30	8.14435	1954	1.00751	4	0.99255	4	60
1	0.12216	29	18612	1931	0.12308	30	12481	1945	0.00755	3	0.99251	3	59
2	0.12245	29	16681	1921	0.12338	29	10536	1936	0.00758	4	0.99248	4	58
3	0.12274	28	14760	1911	0.12367	30	08600	1926	0.00762	3	0.99244	4	57
4	0.12302	29	12849	1903	0.12397	29	06674	1918	0.00765	4	0.99240	3	56
5	0.12331	29	8.10946	1894	0.12426	30	8.04756	1908	1.00769	4	0.99237	4	55
6	0.12360	29	09052	1885	0.12456	29	02848	1900	0.00773	3	0.99233	3	54
7	0.12389	29	07167	1876	0.12485	30	8.00948	1890	0.00776	4	0.99230	4	53
8	0.12418	29	05291	1868	0.12515	29	7.99058	1882	0.00780	4	0.99226	4	52
9	0.12447	29	03423	1858	0.12544	30	97176	1874	0.00784	3	0.99222	3	51
10	0.12476	28	8.01565	1851	0.12574	29	7.95302	1864	1.00787	4	0.99219	4	50
11	0.12504	29	7.99714	1841	0.12603	30	93438	1856	0.00791	4	0.99215	4	49
12	0.12533	29	97873	1833	0.12633	29	91582	1848	0.00795	4	0.99211	3	48
13	0.12562	29	96040	1824	0.12662	30	89734	1839	0.00799	3	0.99208	4	47
14	0.12591	29	94216	1817	0.12692	30	87895	1831	0.00802	4	0.99204	4	46
15	0.12620	29	7.92399	1807	0.12722	29	7.86064	1822	1.00806	4	0.99200	3	45
16	0.12649	29	90592	1800	0.12751	30	84242	1814	0.00810	3	0.99197	4	44
17	0.12678	28	88792	1791	0.12781	29	82428	1806	0.00813	4	0.99193	4	43
18	0.12706	29	87001	1783	0.12810	30	80622	1797	0.00817	4	0.99189	3	42
19	0.12735	29	85218	1775	0.12840	29	78825	1790	0.00821	4	0.99186	4	41
20	0.12764	29	7.83443	1766	0.12869	30	7.77035	1781	1.00825	3	0.99182	4	40
21	0.12793	29	81677	1759	0.12899	30	75254	1774	0.00828	4	0.99178	3	39
22	0.12822	29	79918	1751	0.12929	29	73480	1765	0.00832	4	0.99175	4	38
23	0.12851	29	78167	1743	0.12958	30	71715	1758	0.00836	4	0.99171	4	37
24	0.12880	28	76424	1735	0.12988	29	69957	1749	0.00840	4	0.99167	4	36
25	0.12908	29	7.74689	1727	0.13017	30	7.68208	1742	1.00844	4	0.99163	3	35
26	0.12937	29	72962	1720	0.13047	29	66466	1734	0.00848	3	0.99160	4	34
27	0.12966	29	71242	1712	0.13076	30	64732	1727	0.00851	4	0.99156	4	33
28	0.12995	29	69530	1704	0.13106	30	63005	1718	0.00855	4	0.99152	4	32
29	0.13024	29	67826	1696	0.13136	29	61287	1712	0.00859	4	0.99148	4	31
30	0.13053	28	7.66130	1689	0.13165	30	7.59575	1703	1.00863	4	0.99144	3	30
31	0.13081	29	64441	1682	0.13195	29	57872	1696	0.00867	4	0.99141	4	29
32	0.13110	29	62759	1674	0.13224	30	56176	1689	0.00871	4	0.99137	4	28
33	0.13139	29	61085	1667	0.13254	30	54487	1681	0.00875	3	0.99133	4	27
34	0.13168	29	59418	1659	0.13284	29	52806	1674	0.00878	4	0.99129	4	26
35	0.13197	29	7.57759	1652	0.13313	30	7.51132	1667	1.00882	4	0.99125	3	25
36	0.13226	28	56107	1645	0.13343	29	49465	1667	0.00886	4	0.99122	4	24
37	0.13254	29	54462	1637	0.13372	30	47806	1659	0.00890	4	0.99118	4	23
38	0.13283	29	52825	1631	0.13402	30	46154	1652	0.00894	4	0.99114	4	22
39	0.13312	29	51194	1623	0.13432	29	44509	1645	0.00898	4	0.99110	4	21
40	0.13341	29	7.49571	1616	0.13461	30	7.42871	1638	1.00902	4	0.99106	4	20
41	0.13370	29	47955	1610	0.13491	30	41240	1631	0.00906	4	0.99102	4	19
42	0.13399	29	46346	1603	0.13521	29	39616	1624	0.00910	4	0.99098	4	18
43	0.13427	28	44743	1595	0.13550	30	37999	1617	0.00914	4	0.99094	3	17
44	0.13456	29	43148	1588	0.13580	29	36389	1610	0.00918	4	0.99091	4	16
45	0.13485	29	7.41560	1582	0.13609	30	7.34786	1603	1.00922	4	0.99087	4	15
46	0.13514	29	39978	1575	0.13639	30	33190	1596	0.00926	4	0.99083	4	14
47	0.13543	29	38403	1568	0.13669	29	31600	1590	0.00930	4	0.99079	4	13
48	0.13572	28	36835	1561	0.13698	30	30018	1582	0.00934	4	0.99075	4	12
49	0.13600	29	35274	1555	0.13728	30	28442	1576	0.00938	4	0.99071	4	11
50	0.13629	29	7.33719	1548	0.13758	29	7.26873	1569	1.00942	4	0.99067	4	10
51	0.13658	29	32171	1541	0.13787	30	25310	1563	0.00946	4	0.99063	4	9
52	0.13687	29	30630	1535	0.13817	29	23754	1556	0.00950	4	0.99059	4	8
53	0.13716	28	29095	1529	0.13846	30	22204	1550	0.00954	4	0.99055	4	7
54	0.13744	29	27566	1522	0.13876	30	20661	1543	0.00958	4	0.99051	4	6
55	0.13773	29	7.26044	1515	0.13906	29	7.19125	1536	1.00962	4	0.99047	4	5
56	0.13802	29	24529	1510	0.13935	30	17594	1531	0.00966	4	0.99043	4	4
57	0.13831	29	23019	1502	0.13965	30	16071	1523	0.00970	4	0.99039	4	3
58	0.13860	29	21517	1497	0.13995	29	14553	1518	0.00975	4	0.99035	4	2
59	0.13889	28	20020	1490	0.14024	30	13042	1511	0.00979	4	0.99031	4	1
60	0.13917	28	7.18530	1483	0.14054	30	7.11537	1505	1.00983	4	0.99027	4	0
↑97°	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	↑82°

Natural Trigonometric Functions

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$80^\circ \rightarrow$ ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	$\leftarrow 171^\circ$ ↓
0	0.13917	29	7.18530	1484	0.14054	30	7.11537	1499	1.00983	4	0.99027	4	60
1	.13946	29	.17046	1478	.14084	29	.10038	1492	.00987	4	.99023	4	59
2	.13975	29	.15568	1472	.14113	30	.08546	1487	.00991	4	.99019	4	58
3	.14004	29	.14096	1466	.14143	30	.07059	1480	.00995	4	.99015	4	57
4	.14033	28	.12630	1459	.14173	29	.05579	1474	.00999	5	.99011	5	56
5	0.14061	29	7.11171	1454	0.14202	30	7.04105	1468	1.01004	4	0.99006	4	55
6	.14090	29	.09717	1448	.14232	30	.02637	1463	.01008	4	.99002	4	54
7	.14119	29	.08269	1441	.14262	29	7.01174	1456	.01012	4	.98998	4	53
8	.14148	29	.06828	1436	.14291	30	6.99718	1450	.01016	4	.98994	4	52
9	.14177	28	.05392	1430	.14321	30	.98268	1445	.01020	4	.98990	4	51
10	0.14205	29	7.03962	1424	0.14351	30	6.96823	1438	1.01024	5	0.98986	4	50
11	.14234	29	.02538	1418	.14381	29	.95385	1433	.01029	4	.98982	4	49
12	.14263	29	7.01120	1412	.14410	30	.93952	1427	.01033	4	.98978	5	48
13	.14292	28	6.99703	1407	.14440	30	.92525	1421	.01037	4	.98973	4	47
14	.14320	29	.98301	1401	.14470	29	.91104	1416	.01041	5	.98969	4	46
15	0.14349	29	6.96900	1395	0.14499	30	6.89688	1410	1.01046	4	0.98965	4	45
16	.14378	29	.95505	1390	.14529	30	.88278	1404	.01050	4	.98961	4	44
17	.14407	29	.94115	1384	.14559	29	.86874	1399	.01054	5	.98957	4	43
18	.14436	28	.92731	1379	.14588	30	.85475	1393	.01059	4	.98953	5	42
19	.14464	29	.91352	1373	.14618	30	.84082	1388	.01063	4	.98948	4	41
20	0.14493	29	6.89979	1367	0.14648	30	6.82694	1382	1.01067	4	0.98944	4	40
21	.14522	29	.88612	1362	.14678	29	.81312	1376	.01071	5	.98940	4	39
22	.14551	29	.87250	1357	.14707	30	.79936	1372	.01076	4	.98936	5	38
23	.14580	28	.85893	1351	.14737	30	.78564	1365	.01080	4	.98931	4	37
24	.14608	29	.84542	1346	.14767	29	.77199	1361	.01084	5	.98927	4	36
25	0.14637	29	6.83196	1340	0.14796	30	6.75838	1355	1.01089	4	0.98923	4	35
26	.14666	29	.81856	1335	.14826	30	.74483	1350	.01093	4	.98919	5	34
27	.14695	28	.80521	1330	.14856	30	.73133	1344	.01097	5	.98914	4	33
28	.14723	29	.79191	1325	.14886	29	.71789	1339	.01102	4	.98910	4	32
29	.14752	29	.77866	1319	.14915	30	.70450	1334	.01106	5	.98906	4	31
30	0.14781	29	6.76547	1314	0.14945	30	6.69116	1329	1.01111	4	0.98902	5	30
31	.14810	28	.75233	1309	.14975	30	.67787	1324	.01115	4	.98897	4	29
32	.14838	29	.73924	1304	.15005	29	.66463	1319	.01119	5	.98893	4	28
33	.14867	29	.72620	1299	.15034	30	.65144	1313	.01124	4	.98889	5	27
34	.14896	29	.71321	1294	.15064	30	.63831	1308	.01128	5	.98884	4	26
35	0.14925	29	6.70027	1289	0.15094	30	6.62523	1304	1.01133	4	0.98880	4	25
36	.14954	28	.68738	1284	.15124	29	.61219	1298	.01137	5	.98876	5	24
37	.14982	29	.67454	1278	.15153	30	.59921	1294	.01142	4	.98871	4	23
38	.15011	29	.66176	1274	.15183	30	.58627	1288	.01146	5	.98867	4	22
39	.15040	29	.64902	1269	.15213	30	.57339	1284	.01151	4	.98863	5	21
40	0.15069	28	6.63633	1264	0.15243	29	6.56055	1278	1.01155	5	0.98858	4	20
41	.15097	29	.62369	1259	.15272	30	.54777	1274	.01160	4	.98854	5	19
42	.15126	29	.61110	1255	.15302	30	.53503	1269	.01164	5	.98849	4	18
43	.15155	29	.59855	1249	.15332	30	.52234	1264	.01169	4	.98845	4	17
44	.15184	28	.58606	1245	.15362	29	.50970	1260	.01173	5	.98841	5	16
45	0.15212	29	6.57361	1240	0.15391	30	6.49710	1254	1.01178	4	0.98836	4	15
46	.15241	29	.56121	1235	.15421	30	.48456	1250	.01182	5	.98832	5	14
47	.15270	29	.54886	1231	.15451	30	.47206	1245	.01187	4	.98827	4	13
48	.15299	29	.53655	1226	.15481	30	.45961	1241	.01191	5	.98823	5	12
49	.15327	28	.52429	1221	.15511	29	.44720	1236	.01196	4	.98818	4	11
50	0.15356	29	6.51208	1217	0.15540	30	6.43484	1231	1.01200	5	0.98814	5	10
51	.15385	29	.49991	1212	.15570	30	.42253	1227	.01205	4	.98809	4	9
52	.15414	28	.48779	1207	.15600	30	.41026	1222	.01209	5	.98805	5	8
53	.15442	29	.47572	1203	.15630	30	.39804	1217	.01214	5	.98800	4	7
54	.15471	29	.46369	1198	.15660	29	.38587	1213	.01219	4	.98796	5	6
55	0.15500	29	6.45171	1194	0.15689	30	6.37374	1209	1.01223	5	0.98791	4	5
56	.15529	28	.43977	1190	.15719	30	.36165	1204	.01228	5	.98787	5	4
57	.15557	29	.42787	1185	.15749	30	.34961	1200	.01233	4	.98782	4	3
58	.15586	29	.41602	1180	.15779	30	.33761	1195	.01237	5	.98778	5	2
59	.15615	28	.40422	1177	.15809	29	.32566	1191	.01242	5	.98773	4	1
60	0.15643	28	6.39245		0.15838		6.31375		1.01247		0.98769		0
$\uparrow 98^\circ \rightarrow$	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	$\uparrow 81^\circ$

MT

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Natural Trigonometric Functions

$90^\circ \rightarrow$ \downarrow	\sin	Diff. $1'$	csc	Diff. $1'$	\tan	Diff. $1'$	cot	Diff. $1'$	\tan	Diff. $1'$	sec	Diff. $1'$	\cos	Diff. $1'$	$\rightarrow 170^\circ$ \uparrow
0	0.15643	29	6.39245	1172	0.15838	30	6.31375	1186	1.01247	4	0.98769	5	60		
1	15672	29	38073	1167	15868	30	30189	1182	0.1251	5	98764	4	59		
2	15701	29	36906	1163	15898	30	29007	1178	0.1256	5	98760	5	58		
3	15730	28	35743	1159	15928	30	27829	1174	0.1261	4	98755	5	57		
4	15758	29	34584	1155	15958	30	26655	1169	0.1265	5	98751	5	56		
5	15787	29	33429	1150	15988	29	25486	1165	0.1270	5	98746	5	55		
6	15816	29	32279	1146	16017	30	24321	1161	0.1275	4	98741	5	54		
7	15845	28	31133	1142	16047	30	23160	1157	0.1279	4	98737	4	53		
8	15873	29	29991	1138	16077	30	22003	1152	0.1284	5	98732	5	52		
9	15902	29	28853	1134	16107	30	20851	1148	0.1289	5	98728	5	51		
10	15931	28	27719	1129	0.16137	30	6.19703	1144	1.01294	4	0.98723	5	50		
11	15959	28	26590	1126	16167	29	18559	1140	0.1298	4	98718	5	49		
12	15988	29	25464	1121	16196	30	17419	1136	0.1303	5	98714	4	48		
13	16017	29	24343	1117	16226	30	16283	1132	0.1308	5	98709	5	47		
14	16046	28	23226	1113	16256	30	15151	1128	0.1313	4	98704	4	46		
15	16074	29	22113	1109	0.16286	30	6.14023	1124	1.01317	5	0.98700	4	45		
16	16103	29	21004	1106	16316	30	12899	1120	0.1322	5	98695	5	44		
17	16132	28	19898	1101	16346	30	11779	1115	0.1327	5	98690	5	43		
18	16160	29	18797	1097	16376	29	10664	1112	0.1332	5	98686	5	42		
19	16189	29	17760	1093	16405	30	09552	1108	0.1337	5	98681	5	41		
20	16218	28	16607	1090	0.16435	30	6.08444	1104	1.01342	4	0.98676	5	40		
21	16246	29	15517	1085	16465	30	07340	1100	0.1346	5	98671	4	39		
22	16275	29	14432	1082	16495	30	06240	1097	0.1351	5	98667	5	38		
23	16304	29	13350	1077	16525	30	05143	1092	0.1356	5	98662	5	37		
24	16333	28	12273	1074	16555	30	04051	1089	0.1361	5	98657	5	36		
25	16361	29	6.11199	1070	0.16585	30	6.02962	1084	1.01366	5	0.98652	4	35		
26	16390	29	10129	1067	16615	30	01878	1081	0.1371	5	98648	4	34		
27	16419	28	09062	1062	16645	29	6.00797	1077	0.1376	5	98643	5	33		
28	16447	29	08000	1059	16674	30	5.99720	1074	0.1381	5	98638	5	32		
29	16476	29	06941	1055	16704	30	98646	1070	0.1386	5	98633	5	31		
30	16505	28	6.05886	1052	0.16734	30	5.97576	1066	1.01391	4	0.98629	5	30		
31	16533	28	04834	1047	16764	30	96510	1062	0.1395	5	98624	5	29		
32	16562	29	03787	1044	16794	30	95448	1058	0.1400	5	98619	5	28		
33	16591	29	02742	1041	16824	30	94390	1055	0.1405	5	98614	5	27		
34	16620	28	01703	1036	16854	30	93335	1052	0.1410	5	98609	5	26		
35	16648	29	6.00666	1033	0.16884	30	5.92283	1047	1.01415	5	0.98604	4	25		
36	16677	29	5.99633	1030	16914	30	91236	1045	0.1420	5	98600	5	24		
37	16706	28	98603	1026	16944	30	90191	1040	0.1425	5	98595	5	23		
38	16734	29	97577	1022	16974	30	89151	1037	0.1430	5	98590	5	22		
39	16763	29	96555	1019	17004	29	88114	1034	0.1435	5	98585	5	21		
40	16792	28	5.95536	1015	0.17033	30	5.87080	1029	1.01440	5	0.98580	5	20		
41	16820	29	94521	1012	17063	30	86051	1027	0.1445	5	98575	5	19		
42	16849	29	93509	1008	17093	30	85024	1023	0.1450	5	98570	5	18		
43	16878	28	92501	1005	17123	30	84001	1019	0.1455	5	98565	5	17		
44	16906	29	91496	1001	17153	30	82982	1016	0.1460	6	98561	5	16		
45	16935	29	5.90495	998	0.17183	30	5.81966	1013	1.01466	5	0.98556	5	15		
46	16964	28	89497	995	17213	30	80953	1009	0.1471	5	98551	5	14		
47	16992	29	88502	991	17243	30	79944	1006	0.1476	5	98546	5	13		
48	17021	29	87511	987	17273	30	78938	1002	0.1481	5	98541	5	12		
49	17050	28	86524	985	17303	30	77936	999	0.1486	5	98536	5	11		
50	17078	29	85538	981	0.17333	30	5.76937	996	1.01491	5	0.98531	5	10		
51	17107	29	84559	977	17363	30	75941	992	0.1496	5	98526	5	9		
52	17136	28	83581	975	17393	30	74949	989	0.1501	5	98521	5	8		
53	17164	28	82606	971	17423	30	73960	986	0.1506	6	98516	5	7		
54	17193	29	81635	968	17453	30	72974	982	0.1512	5	98511	5	6		
55	17222	28	80667	964	0.17483	30	5.71992	979	1.01517	5	0.98506	5	5		
56	17250	29	79703	961	17513	30	71013	976	0.1522	5	98501	5	4		
57	17279	29	78742	959	17543	30	70037	973	0.1527	5	98496	5	3		
58	17308	28	77783	954	17573	30	69064	970	0.1532	5	98491	5	2		
59	17336	29	76829	952	17603	30	68094	966	0.1537	6	98486	5	1		
60	17365	29	5.75877	952	0.17633	30	5.67128	966	1.01543	6	0.98481	5	0		

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Natural Trigonometric Functions

$100^\circ \rightarrow$ ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	$\leftarrow 169^\circ$ ↑
0	0.17365	28	5.75877	948	0.17633	30	5.67128	963	1.01543	5	0.98481	5	69
1	17393	29	74929	946	17663	30	66165	960	01548	5	98476	5	59
2	17422	29	73983	942	17693	30	65205	957	01553	5	98471	5	58
3	17451	28	73041	939	17723	30	64248	953	01558	5	98466	5	57
4	17479	29	72102	936	17753	30	63295	951	01564	5	98461	5	56
5	17509	29	71166	932	017783	30	5.63244	947	1.01569	5	0.98455	5	55
6	17537	28	70234	930	17813	30	61397	945	01574	5	98450	5	54
7	17565	29	69304	927	17843	30	60452	941	01579	5	98445	5	53
8	17594	29	68377	923	17873	30	59511	938	01585	5	98440	5	52
9	17623	28	67454	921	17903	30	58573	935	01590	5	98435	5	51
10	0.17651	29	66533	917	0.17933	30	5.57638	932	1.01595	5	0.98430	5	50
11	17680	28	65616	915	17963	30	56706	929	01601	5	98425	5	49
12	17708	29	64701	911	17993	30	55777	926	01606	5	98420	5	48
13	17737	29	63790	909	18023	30	54851	924	01611	5	98414	5	47
14	17766	28	62881	905	18053	30	53927	920	01616	5	98409	5	46
15	0.17794	29	61976	903	0.18083	30	5.53007	917	1.01622	5	0.98404	5	45
16	17823	29	61073	899	18113	30	52090	914	01627	5	98399	5	44
17	17852	28	60174	897	18143	30	51176	912	01633	5	98394	5	43
18	17880	29	59277	894	18173	30	50262	908	01638	5	98389	5	42
19	17909	28	58383	890	18203	30	49356	905	01643	5	98383	5	41
20	0.17937	29	5.57493	888	0.18233	30	5.48451	903	1.01649	5	0.98378	5	40
21	17966	29	56605	885	18263	30	47548	900	01654	5	98373	5	39
22	17995	28	55720	883	18293	30	46641	897	01659	5	98368	5	38
23	18023	29	54837	879	18323	30	45751	894	01665	5	98362	5	37
24	18052	29	53958	877	18353	31	44857	891	01670	5	98357	5	36
25	0.18081	28	5.53081	873	0.18384	30	5.43966	888	1.01676	5	0.98352	5	35
26	18109	29	52208	871	18414	30	43078	886	01681	5	98347	5	34
27	18138	28	51337	869	18444	30	42192	883	01687	5	98341	5	33
28	18166	29	50468	865	18474	30	41309	880	01692	5	98336	5	32
29	18195	28	49603	863	18504	30	40429	877	01698	5	98331	5	31
30	0.18224	28	5.48740	859	0.18534	30	5.39552	875	1.01703	5	0.98325	5	30
31	18252	29	47881	858	18564	30	38677	872	01709	5	98320	5	29
32	18281	28	47023	854	18594	30	37805	869	01714	5	98315	5	28
33	18300	29	46169	852	18624	30	36936	866	01720	5	98310	5	27
34	18338	29	45317	849	18654	30	36070	864	01725	5	98304	5	26
35	0.18367	28	5.44468	846	0.18684	30	5.35206	861	1.01731	5	0.98299	5	25
36	18395	29	43622	844	18714	31	34345	858	01736	5	98294	5	24
37	18424	28	42778	841	18745	30	33487	856	01742	5	98288	5	23
38	18452	29	41937	838	18775	30	32631	853	01747	5	98283	5	22
39	18481	28	41099	836	18805	30	31778	850	01753	5	98277	5	21
40	0.18509	29	5.40263	833	0.18835	30	5.30928	848	1.01758	5	0.98272	5	20
41	18537	29	39430	830	18865	30	30080	845	01764	5	98267	5	19
42	18567	28	38600	828	18895	30	29235	842	01769	5	98261	5	18
43	18595	29	37772	825	18925	30	28393	840	01775	5	98256	5	17
44	18624	28	36947	823	18955	31	27553	838	01781	5	98250	5	16
45	0.18652	29	5.36124	820	0.18986	30	5.26715	835	1.01786	5	0.98245	5	15
46	18681	29	35304	818	19016	30	25880	832	01792	5	98240	5	14
47	18710	28	34486	815	19046	30	25048	830	01798	5	98234	5	13
48	18738	29	33671	812	19076	30	24218	827	01803	5	98229	5	12
49	18767	28	32859	810	19106	30	23391	825	01809	5	98223	5	11
50	0.18795	29	5.32049	808	0.19136	30	5.22566	822	1.01815	5	0.98218	5	10
51	18824	28	31241	805	19166	31	21744	819	01820	5	98212	5	9
52	18852	29	30436	802	19196	30	20925	818	01826	5	98207	5	8
53	18881	29	29634	801	19227	30	20107	814	01832	5	98201	5	7
54	18910	28	28833	797	19257	30	19293	813	01837	5	98196	5	6
55	0.18938	29	5.28036	795	0.19287	30	5.18430	809	1.01843	5	0.98190	5	5
56	18967	28	27241	793	19317	30	17671	808	01849	5	98185	5	4
57	18995	29	26448	790	19347	31	16863	805	01854	5	98179	5	3
58	19024	28	25658	788	19378	30	16058	802	01860	5	98174	5	2
59	19052	29	24870	786	19408	30	15256	801	01866	5	98168	5	1
60	0.19081	5	5.24084	786	0.49438	30	5.14455	801	1.01872	6	0.98163	5	0

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Natural Trigonometric Functions

11° ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	168° ↓
0	0.19081	28	5.24084	783	0.19438	30	5.14455	797	1.01872	5	0.98163	6	60
1	.19109	29	.23301	780	.19468	30	.13658	796	.01877	6	.98157	5	59
2	.19138	29	.22521	779	.19498	31	.12862	793	.01883	6	.98152	6	58
3	.19167	28	.21742	776	.19529	30	.12069	790	.01889	6	.98146	6	57
4	.19195	29	.20966	773	.19559	30	.11279	789	.01895	6	.98140	5	56
5	0.19224	28	5.20193	772	0.19589	30	5.10490	786	1.01901	5	0.98135	6	55
6	.19252	29	.19421	769	.19619	30	.09704	783	.01906	6	.98129	5	54
7	.19281	28	.18652	766	.19649	30	.08921	782	.01912	6	.98124	6	53
8	.19309	29	.17886	765	.19680	31	.08139	779	.01918	6	.98118	6	52
9	.19338	28	.17121	762	.19710	30	.07360	776	.01924	6	.98112	5	51
10	0.19366	29	5.16359	760	0.19740	30	5.06584	775	1.01930	6	0.98107	6	50
11	.19395	28	.15599	757	.19770	30	.05809	772	.01936	5	.98101	5	49
12	.19423	29	.14842	755	.19801	31	.05037	770	.01941	6	.98096	6	48
13	.19452	29	.14087	753	.19831	30	.04267	768	.01947	6	.98090	6	47
14	.19481	28	.13334	751	.19861	30	.03499	765	.01953	6	.98084	5	46
15	0.19509	29	5.12583	748	0.19891	30	5.02734	763	1.01959	6	0.98079	6	45
16	.19538	28	.11835	747	.19921	31	.01971	761	.01965	6	.98073	6	44
17	.19566	29	.11088	744	.19952	30	.01210	759	.01971	6	.98067	6	43
18	.19595	28	.10344	742	.19982	30	5.00451	756	.01977	6	.98061	5	42
19	.19623	29	.09602	739	.20012	30	4.99695	755	.01983	6	.98056	6	41
20	0.19652	28	5.08863	738	0.20042	31	4.98940	752	1.01989	6	0.98050	6	40
21	.19680	29	.08125	735	.20073	30	.98188	750	.01995	6	.98044	5	39
22	.19709	28	.07390	733	.20103	30	.97438	748	.02001	6	.98039	6	38
23	.19737	29	.06657	731	.20133	31	.96690	745	.02007	6	.98033	6	37
24	.19766	28	.05926	729	.20164	30	.95945	744	.02013	6	.98027	6	36
25	0.19794	29	5.05197	726	0.20194	30	4.95201	741	1.02019	6	0.98021	5	35
26	.19823	28	.04471	725	.20224	30	.94460	739	.02025	6	.98016	6	34
27	.19851	29	.03746	722	.20254	31	.93721	737	.02031	6	.98010	6	33
28	.19880	28	.03024	721	.20285	30	.92984	735	.02037	6	.98004	6	32
29	.19908	29	.02303	718	.20315	30	.92249	733	.02043	6	.97998	6	31
30	0.19937	28	5.01585	716	0.20345	31	4.91516	731	1.02049	6	0.97992	5	30
31	.19965	29	.00869	714	.20376	30	.90785	729	.02055	6	.97987	6	29
32	.19994	28	5.00155	712	.20406	30	.90056	726	.02061	6	.97981	6	28
33	.20022	29	4.99443	710	.20436	30	.89330	725	.02067	6	.97975	6	27
34	.20051	28	.98733	708	.20466	31	.88605	723	.02073	6	.97969	6	26
35	0.20079	29	4.98025	705	0.20497	30	4.87882	720	1.02079	6	0.97963	5	25
36	.20108	28	.97320	704	.20527	30	.87162	718	.02085	6	.97958	6	24
37	.20136	29	.96616	702	.20557	31	.86444	717	.02091	6	.97952	6	23
38	.20165	28	.95914	699	.20588	30	.85727	714	.02097	6	.97946	6	22
39	.20193	29	.95215	698	.20618	30	.85013	713	.02103	7	.97940	6	21
40	0.20222	28	4.94517	696	0.20648	31	4.84300	710	1.02110	6	0.97934	6	20
41	.20250	29	.93821	693	.20679	30	.83590	708	.02116	6	.97928	6	19
42	.20279	28	.93128	692	.20709	30	.82882	707	.02122	6	.97922	6	18
43	.20307	29	.92436	690	.20739	31	.82175	704	.02128	6	.97916	6	17
44	.20336	28	.91746	688	.20770	30	.81471	702	.02134	6	.97910	5	16
45	0.20364	29	4.91058	685	0.20800	30	4.80769	701	1.02140	6	0.97905	6	15
46	.20393	28	.90373	684	.20830	31	.80068	698	.02146	7	.97899	6	14
47	.20421	29	.89689	682	.20861	30	.79370	697	.02153	6	.97893	6	13
48	.20450	28	.89007	680	.20891	30	.78673	695	.02159	6	.97887	6	12
49	.20478	29	.88327	678	.20921	31	.77978	692	.02165	6	.97881	6	11
50	0.20507	28	4.87649	676	0.20952	30	4.77286	691	1.02171	7	0.97875	6	10
51	.20535	28	.86973	674	.20982	31	.76595	689	.02178	6	.97869	6	9
52	.20563	29	.86299	672	.21013	30	.75906	687	.02184	6	.97863	6	8
53	.20592	28	.85627	671	.21043	30	.75219	685	.02190	6	.97857	6	7
54	.20620	29	.84956	668	.21073	31	.74534	683	.02196	7	.97851	6	6
55	0.20649	28	4.84288	667	0.21104	30	4.73851	681	1.02203	6	0.97845	6	5
56	.20677	29	.83621	665	.21134	30	.73170	680	.02209	6	.97839	6	4
57	.20706	28	.82956	662	.21164	31	.72490	677	.02215	6	.97833	6	3
58	.20734	29	.82294	661	.21195	30	.71813	676	.02221	7	.97827	6	2
59	.20763	28	.81633	660	.21225	31	.71137	674	.02228	6	.97821	6	1
60	0.20791	28	4.80973		0.21256		4.70463		1.02234		0.97815		0
↑ 101°	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	↑ 78°

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Natural Trigonometric Functions

120° ↑	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	167° ↓
0	0.26791	29	80973	657	0.21256	30	4.70463	672	1.02234	6.	0.97815	6	60
1	20820	28	80316	655	21286	30	69791	679	0.22440	7	97809	6	59
2	20848	29	79661	654	21316	31	69121	669	0.22447	6	97803	6	58
3	20877	28	79007	652	21347	30	68452	666	0.22533	7	97797	6	57
4	20905	28	78355	650	21377	31	67786	665	0.2259	6	97791	7	56
5	20933	29	77705	648	0.21408	30	4.67121	663	1.02266	6	0.97784	6	55
6	20962	28	77057	646	21438	31	66458	661	0.22272	7	97778	6	54
7	20990	29	76411	645	21469	30	65797	659	0.22279	6	97772	6	53
8	21019	28	75766	643	21499	30	65138	658	0.22285	6	97766	6	52
9	21047	29	75123	641	21529	31	64480	655	0.22291	7	97760	6	51
10	21076	28	74482	639	0.21560	30	4.63825	654	1.02298	6	0.97754	6	50
11	21104	28	73843	638	21590	31	63171	653	0.2304	7	97748	6	49
12	21132	29	73205	636	21621	30	62518	650	0.2311	6	97742	6	48
13	21161	28	72569	634	21651	31	61868	649	0.2317	6	97735	6	47
14	21189	29	71935	632	21682	30	61219	647	0.2323	7	97729	6	46
15	21218	28	71303	630	0.21712	31	4.60572	645	1.02330	6	0.97723	6	45
16	21246	29	70673	629	21743	30	59927	644	0.2336	7	97717	6	44
17	21275	28	70044	627	21773	31	59283	642	0.2343	6	97711	6	43
18	21303	28	69417	626	21804	30	58641	640	0.2349	7	97705	7	42
19	21331	29	68791	624	21834	30	58001	638	0.2356	6	97698	6	41
20	21360	28	68167	622	0.21864	31	4.57363	637	1.02362	7	0.97692	6	40
21	21388	29	67545	620	21895	30	56726	635	0.2369	6	97686	6	39
22	21417	28	66925	618	21925	31	56091	633	0.2375	7	97680	6	38
23	21445	29	66307	617	21956	30	55458	632	0.2382	6	97673	7	37
24	21474	28	65690	616	21986	31	54826	630	0.2388	7	97667	6	36
25	21502	28	65074	613	0.22017	30	4.54196	628	1.02395	7	0.97661	6	35
26	21530	29	64461	612	22047	31	53558	627	0.2402	6	97655	7	34
27	21559	28	63849	611	22078	30	52941	625	0.2498	7	97648	6	33
28	21587	29	63238	608	22108	31	52316	623	0.2415	6	97642	6	32
29	21616	28	62630	607	22139	30	51693	622	0.2421	7	97636	6	31
30	21644	28	62023	606	0.22169	31	4.51071	620	1.02428	7	0.97630	7	30
31	21672	29	61417	604	22200	30	50451	619	0.2435	6	97623	6	29
32	21701	28	60813	602	22231	31	49832	617	0.2441	7	97617	6	28
33	21729	29	60211	600	22261	30	49215	615	0.2448	6	97611	7	27
34	21758	28	59611	599	22292	31	48600	614	0.2454	7	97604	6	26
35	21786	28	59012	598	0.22322	30	4.47986	612	1.02461	7	0.97598	6	25
36	21814	29	58414	595	22353	31	47374	610	0.2468	6	97592	7	24
37	21843	28	57819	595	22383	30	46784	609	0.2474	7	97585	6	23
38	21871	29	57224	592	22414	31	46195	607	0.2481	6	97579	7	22
39	21899	28	56632	591	22444	30	45600	606	0.2488	7	97573	6	21
40	21928	28	56041	590	0.22475	31	4.44942	604	1.02494	7	0.97566	6	20
41	21956	29	55451	588	22505	30	43838	603	0.2501	6	97560	7	19
42	21985	28	54863	586	22536	31	43235	601	0.2508	7	97553	6	18
43	22013	28	54277	585	22567	30	42634	600	0.2515	6	97547	6	17
44	22041	29	53692	583	22597	31	42034	598	0.2521	7	97541	7	16
45	22070	28	53109	582	0.22628	30	4.41936	596	1.02528	7	0.97534	6	15
46	22098	28	52527	580	22658	31	41340	595	0.2535	6	97528	7	14
47	22126	29	51947	579	22689	30	40745	593	0.2542	7	97521	6	13
48	22155	28	51368	577	22719	31	40152	592	0.2548	6	97515	7	12
49	22183	29	50791	575	22750	30	39560	591	0.2555	7	97508	6	11
50	22212	28	50216	574	0.22781	31	4.38969	588	1.02562	7	0.97502	6	10
51	22240	28	49642	573	22811	30	38381	588	0.2569	6	97496	7	9
52	22268	29	49069	571	22842	31	37793	586	0.2576	8	97489	6	8
53	22297	28	48498	570	22872	30	37207	584	0.2582	7	97483	7	7
54	22325	28	47928	568	22903	31	36623	583	0.2589	7	97476	6	6
55	22353	29	47360	567	0.22934	30	4.36049	581	1.02596	7	0.97470	7	5
56	22382	28	46793	565	22964	31	35459	580	0.2603	6	97463	6	4
57	22410	28	46228	564	22995	30	34879	579	0.2610	7	97457	6	3
58	22438	29	45664	562	23026	31	34300	577	0.2617	7	97450	7	2
59	22467	28	45102	561	23056	30	33723	575	0.2624	7	97444	6	1
60	22495	28	44541	561	0.23087	31	4.33148	575	1.02630	6	0.97437	7	0

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Natural Trigonometric Functions

130°		Diff.			Diff.			Diff.			Diff.	+166°	
↓	sin	1'	csc	1'	tan	1'	cot	1'	sec	1'	cos	Diff.	↓
0	0.22495	28	4.44541	559	0.23087	30	4.33148	575	1.02630	7	0.97437	7	60
1	0.22523	29	4.43982	558	0.23117	31	4.32573	572	1.02637	7	0.97430	6	59
2	0.22552	28	4.43424	557	0.23148	31	4.32001	571	1.02644	7	0.97424	7	58
3	0.22580	28	4.42867	555	0.23179	30	4.31430	570	1.02651	7	0.97417	6	57
4	0.22608	29	4.42312	553	0.23209	31	4.30860	569	1.02658	7	0.97411	7	56
5	0.22637	28	4.41759	553	0.23240	31	4.30291	567	1.02665	7	0.97404	6	55
6	0.22665	28	4.41206	550	0.23271	30	4.29724	565	1.02672	7	0.97398	7	54
7	0.22693	29	4.40656	550	0.23301	31	4.29159	564	1.02679	7	0.97391	7	53
8	0.22722	28	4.40106	548	0.23332	31	4.28595	563	1.02686	7	0.97384	6	52
9	0.22750	28	4.39558	546	0.23363	30	4.28032	561	1.02693	7	0.97378	7	51
10	0.22778	29	4.39012	546	0.23393	31	4.27471	560	1.02700	7	0.97371	6	50
11	0.22807	28	4.38466	543	0.23424	31	4.26911	559	1.02707	7	0.97365	7	49
12	0.22835	28	4.37923	543	0.23455	30	4.26352	557	1.02714	7	0.97358	7	48
13	0.22863	29	4.37380	541	0.23485	31	4.25795	556	1.02721	7	0.97351	6	47
14	0.22892	28	4.36839	540	0.23516	31	4.25239	554	1.02728	7	0.97345	7	46
15	0.22920	28	4.36299	538	0.23547	31	4.24685	553	1.02735	7	0.97338	6	45
16	0.22948	29	4.35761	537	0.23578	30	4.24132	552	1.02742	7	0.97331	7	44
17	0.22977	28	4.35224	535	0.23608	31	4.23580	550	1.02749	7	0.97325	6	43
18	0.23005	28	4.34689	535	0.23639	31	4.23030	549	1.02756	7	0.97318	7	42
19	0.23033	29	4.34154	532	0.23670	30	4.22481	548	1.02763	7	0.97311	6	41
20	0.23062	28	4.33622	532	0.23700	31	4.21933	546	1.02770	7	0.97304	7	40
21	0.23090	28	4.33090	530	0.23731	31	4.21387	545	1.02777	7	0.97298	6	39
22	0.23118	28	4.32560	529	0.23762	31	4.20842	544	1.02784	7	0.97291	7	38
23	0.23146	29	4.32031	528	0.23793	30	4.20298	542	1.02791	8	0.97284	6	37
24	0.23175	28	4.31503	526	0.23823	31	4.19756	541	1.02799	7	0.97278	7	36
25	0.23203	28	4.30977	525	0.23854	31	4.19215	540	1.02806	7	0.97271	6	35
26	0.23231	29	4.30452	523	0.23885	31	4.18675	538	1.02813	7	0.97264	7	34
27	0.23260	28	4.29929	523	0.23916	30	4.18137	537	1.02820	7	0.97257	6	33
28	0.23288	28	4.29406	521	0.23946	31	4.17600	536	1.02827	7	0.97251	7	32
29	0.23316	29	4.28885	519	0.23977	31	4.17064	534	1.02834	8	0.97244	6	31
30	0.23345	28	4.28366	519	0.24008	31	4.16530	533	1.02842	7	0.97237	7	30
31	0.23373	28	4.27847	517	0.24039	30	4.15997	532	1.02849	7	0.97230	6	29
32	0.23401	28	4.27330	516	0.24069	31	4.15465	531	1.02856	7	0.97223	7	28
33	0.23429	29	4.26814	514	0.24100	31	4.14934	529	1.02863	7	0.97217	6	27
34	0.23458	28	4.26300	513	0.24131	31	4.14405	528	1.02870	8	0.97210	7	26
35	0.23486	28	4.25787	512	0.24162	31	4.13877	527	1.02878	7	0.97203	6	25
36	0.23514	28	4.25275	511	0.24193	30	4.13350	525	1.02885	7	0.97196	7	24
37	0.23542	29	4.24764	509	0.24223	31	4.12825	524	1.02892	7	0.97189	6	23
38	0.23571	28	4.24255	509	0.24254	31	4.12301	523	1.02899	8	0.97182	7	22
39	0.23599	28	4.23746	507	0.24285	31	4.11778	522	1.02907	7	0.97176	6	21
40	0.23627	29	4.23239	505	0.24316	31	4.11256	520	1.02914	7	0.97169	7	20
41	0.23656	28	4.22734	505	0.24347	30	4.10736	520	1.02921	7	0.97162	6	19
42	0.23684	28	4.22229	503	0.24377	31	4.10216	517	1.02928	8	0.97155	7	18
43	0.23712	28	4.21726	502	0.24408	31	4.09699	517	1.02936	7	0.97148	6	17
44	0.23740	29	4.21224	501	0.24439	31	4.09182	516	1.02943	7	0.97141	7	16
45	0.23769	28	4.20723	499	0.24470	31	4.08666	514	1.02950	8	0.97134	6	15
46	0.23797	28	4.20224	499	0.24501	31	4.08152	513	1.02958	7	0.97127	7	14
47	0.23825	28	4.19725	497	0.24532	30	4.07639	512	1.02965	7	0.97120	6	13
48	0.23853	29	4.19228	495	0.24562	31	4.07127	511	1.02972	8	0.97113	7	12
49	0.23882	28	4.18733	495	0.24593	31	4.06616	509	1.02980	7	0.97106	6	11
50	0.23910	28	4.18238	494	0.24624	31	4.06107	508	1.02987	7	0.97100	5	10
51	0.23938	28	4.17744	492	0.24655	31	4.05599	507	1.02994	8	0.97093	7	9
52	0.23966	29	4.17252	491	0.24686	31	4.05092	506	1.03002	7	0.97086	6	8
53	0.23995	28	4.16761	490	0.24717	30	4.04586	505	1.03009	8	0.97079	7	7
54	0.24023	28	4.16271	489	0.24747	31	4.04081	503	1.03017	7	0.97072	6	6
55	0.24051	28	4.15782	487	0.24778	31	4.03578	502	1.03024	8	0.97065	5	5
56	0.24079	29	4.15295	486	0.24809	31	4.03076	502	1.03032	7	0.97058	7	4
57	0.24108	28	4.14809	486	0.24840	31	4.02574	500	1.03039	7	0.97051	6	3
58	0.24136	28	4.14323	484	0.24871	31	4.02074	498	1.03046	8	0.97044	7	2
59	0.24164	28	4.13839	482	0.24902	31	4.01576	498	1.03054	7	0.97037	6	1
60	0.24192	28	4.13357		0.24933	31	4.01078		1.03061	7	0.97030	5	0
↑	103°	cos	Diff.	sec	Diff.	cot	Diff.	tan	Diff.	csc	Diff.	sin	↑
			1'		1'		1'		1'		1'		76°

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Natural Trigonometric Functions

14°		Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	165°
↓	sin												↑
0	0.24192	28	4.13357	482	0.24933	31	4.01078	496	1.03061	8	0.97030	7	60
1	0.24220	29	4.12875	481	0.24964	31	4.00582	496	1.03069	7	0.97023	8	59
2	0.24249	28	4.12394	479	0.24995	31	4.00086	494	1.03076	8	0.97015	7	58
3	0.24277	28	4.11915	478	0.25026	30	3.99592	493	1.03084	7	0.97008	7	57
4	0.24305	28	4.11437	477	0.25056	31	3.99099	492	1.03091	8	0.97001	7	56
5	0.24333	29	4.10960	476	0.25087	31	3.98607	490	1.03099	7	0.96994	7	55
6	0.24362	28	4.10484	475	0.25118	31	3.98117	490	1.03106	8	0.96987	7	54
7	0.24390	28	4.10009	474	0.25149	31	3.97627	488	1.03114	7	0.96980	7	53
8	0.24418	28	4.09535	472	0.25180	31	3.97139	488	1.03121	8	0.96973	7	52
9	0.24446	28	4.09063	472	0.25211	31	3.96651	486	1.03129	8	0.96966	7	51
10	0.24474	29	4.08591	470	0.25242	31	3.96165	485	1.03137	7	0.96959	7	50
11	0.24503	28	4.08121	469	0.25273	31	3.95680	484	1.03144	8	0.96952	7	49
12	0.24531	28	4.07652	468	0.25304	31	3.95196	483	1.03152	7	0.96945	8	48
13	0.24559	28	4.07184	467	0.25335	31	3.94713	481	1.03159	8	0.96937	7	47
14	0.24587	28	4.06717	466	0.25366	31	3.94232	481	1.03167	8	0.96930	7	46
15	0.24615	29	4.06251	465	0.25397	31	3.93751	480	1.03175	7	0.96923	7	45
16	0.24644	28	4.05786	464	0.25428	31	3.93271	478	1.03182	8	0.96916	7	44
17	0.24672	28	4.05322	462	0.25459	31	3.92793	477	1.03190	8	0.96909	7	43
18	0.24700	28	4.04860	462	0.25490	31	3.92316	477	1.03197	8	0.96902	7	42
19	0.24728	28	4.04398	460	0.25521	31	3.91839	475	1.03205	8	0.96894	8	41
20	0.24756	28	4.03938	459	0.25552	31	3.91364	474	1.03213	7	0.96887	7	40
21	0.24784	29	4.03479	459	0.25583	31	3.90890	473	1.03220	8	0.96880	7	39
22	0.24813	28	4.03020	457	0.25614	31	3.90417	472	1.03228	8	0.96873	7	38
23	0.24841	28	4.02563	456	0.25645	31	3.89945	471	1.03236	8	0.96866	8	37
24	0.24869	28	4.02107	455	0.25676	31	3.89474	470	1.03244	8	0.96858	7	36
25	0.24897	28	4.01652	454	0.25707	31	3.89004	468	1.03251	7	0.96851	7	35
26	0.24925	29	4.01198	453	0.25738	31	3.88536	468	1.03259	8	0.96844	7	34
27	0.24954	28	4.00745	452	0.25769	31	3.88068	467	1.03267	8	0.96837	7	33
28	0.24982	28	4.00293	450	0.25800	31	3.87601	465	1.03275	8	0.96829	8	32
29	0.25010	28	3.99843	450	0.25831	31	3.87136	465	1.03282	7	0.96822	7	31
30	0.25038	28	3.99393	449	0.25862	31	3.86671	463	1.03299	8	0.96815	8	30
31	0.25066	28	3.98944	447	0.25893	31	3.86208	463	1.03298	8	0.96807	7	29
32	0.25094	28	3.98497	447	0.25924	31	3.85745	461	1.03306	8	0.96800	7	28
33	0.25122	29	3.98050	446	0.25955	31	3.85284	460	1.03313	8	0.96793	7	27
34	0.25151	28	3.97604	444	0.25986	31	3.84824	460	1.03321	8	0.96786	8	26
35	0.25179	28	3.97160	444	0.26017	31	3.84364	458	1.03329	8	0.96778	7	25
36	0.25207	28	3.96716	442	0.26048	31	3.83906	457	1.03337	8	0.96771	7	24
37	0.25235	28	3.96274	442	0.26079	31	3.83449	457	1.03345	8	0.96764	7	23
38	0.25263	28	3.95832	440	0.26110	31	3.82992	455	1.03353	8	0.96756	8	22
39	0.25291	29	3.95392	440	0.26141	31	3.82537	454	1.03360	7	0.96749	7	21
40	0.25320	28	3.94952	438	0.26172	31	3.82083	453	1.03368	8	0.96742	8	20
41	0.25348	28	3.94514	438	0.26203	32	3.81630	453	1.03376	8	0.96734	7	19
42	0.25376	28	3.94076	436	0.26235	31	3.81177	451	1.03384	8	0.96727	8	18
43	0.25404	28	3.93640	436	0.26266	31	3.80726	450	1.03392	8	0.96719	7	17
44	0.25432	28	3.93204	434	0.26297	31	3.80276	449	1.03400	8	0.96712	7	16
45	0.25460	28	3.92770	433	0.26328	31	3.79827	449	1.03408	8	0.96705	7	15
46	0.25488	28	3.92337	433	0.26359	31	3.79378	447	1.03416	8	0.96697	7	14
47	0.25516	29	3.91904	431	0.26390	31	3.78931	446	1.03424	8	0.96690	7	13
48	0.25545	28	3.91473	431	0.26421	31	3.78485	445	1.03432	7	0.96682	7	12
49	0.25573	28	3.91042	429	0.26452	31	3.78040	445	1.03439	8	0.96675	7	11
50	0.25601	28	3.90613	429	0.26483	31	3.77595	443	1.03447	8	0.96667	7	10
51	0.25629	28	3.90184	428	0.26515	31	3.77152	443	1.03455	8	0.96660	7	9
52	0.25657	28	3.89756	426	0.26546	31	3.76709	441	1.03463	8	0.96653	7	8
53	0.25685	28	3.89304	426	0.26577	31	3.76268	440	1.03471	8	0.96645	7	7
54	0.25713	28	3.88904	425	0.26608	31	3.75828	440	1.03479	8	0.96638	7	6
55	0.25741	28	3.88479	423	0.26639	31	3.75388	438	1.03487	8	0.96630	7	5
56	0.25769	29	3.88056	423	0.26670	31	3.74950	438	1.03495	8	0.96623	7	4
57	0.25798	28	3.87633	422	0.26701	32	3.74512	437	1.03503	8	0.96615	7	3
58	0.25826	28	3.87211	421	0.26733	31	3.74075	435	1.03511	9	0.96608	7	2
59	0.25854	28	3.86790	420	0.26764	31	3.73640	435	1.03520	9	0.96600	8	1
60	0.25882	28	3.86370	420	0.26795	31	3.73205	435	1.03528	8	0.96593	7	0

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Natural Trigonometric Functions

15° ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	+164° ↓
0	0.25882	28	3.86370	419	0.26795	31	3.73205	434	1.03528	8	0.96593	8	60
1	.25910	28	.85951	418	.26826	31	.72771	433	.03536	8	.96585	7	59
2	.25938	28	.85533	417	.26857	31	.72338	431	.03544	8	.96578	8	58
3	.25966	28	.85116	416	.26888	32	.71907	431	.03552	8	.96570	8	57
4	.25994	28	.84700	415	.26920	31	.71476	430	.03560	8	.96562	7	56
5	0.26022	28	3.84285	414	0.26951	31	3.71046	430	1.03568	8	0.96555	8	55
6	.26050	28	.83871	414	.26982	31	.70616	428	.03576	8	.96547	7	54
7	.26079	28	.83457	412	.27013	31	.70188	427	.03584	8	.96540	8	53
8	.26107	28	.83045	412	.27044	32	.69761	426	.03592	9	.96532	8	52
9	.26135	28	.82633	410	.27076	31	.69335	426	.03601	8	.96524	7	51
10	0.26163	28	3.82223	410	0.27107	31	3.68909	424	1.03609	8	0.96517	8	50
11	.26191	28	.81813	409	.27138	31	.68485	424	.03617	8	.96509	7	49
12	.26219	28	.81404	408	.27169	32	.68061	423	.03625	8	.96502	8	48
13	.26247	28	.80996	407	.27201	31	.67638	421	.03633	9	.96494	8	47
14	.26275	28	.80589	406	.27232	31	.67217	421	.03642	8	.96486	7	46
15	0.26303	28	3.80183	405	0.27263	31	3.66796	420	1.03650	8	0.96479	8	45
16	.26331	28	.79778	404	.27294	32	.66376	419	.03658	8	.96471	8	44
17	.26359	28	.79374	404	.27326	31	.65957	419	.03666	8	.96463	7	43
18	.26387	28	.78970	402	.27357	31	.65538	417	.03674	9	.96456	8	42
19	.26415	28	.78568	402	.27388	31	.65121	416	.03683	8	.96448	8	41
20	0.26443	28	3.78166	401	0.27419	32	3.64705	416	1.03691	8	0.96440	7	40
21	.26471	28	.77765	400	.27451	31	.64289	415	.03699	9	.96433	8	39
22	.26500	28	.77365	399	.27482	31	.63874	413	.03708	8	.96425	8	38
23	.26528	28	.76966	398	.27513	32	.63461	413	.03716	8	.96417	7	37
24	.26556	28	.76568	397	.27545	31	.63048	412	.03724	8	.96410	8	36
25	0.26584	28	3.76171	396	0.27576	31	3.62636	412	1.03732	9	0.96402	8	35
26	.26612	28	.75775	396	.27607	31	.62224	410	.03741	8	.96394	8	34
27	.26640	28	.75379	395	.27638	32	.61814	409	.03749	8	.96386	7	33
28	.26668	28	.74984	393	.27670	31	.61405	409	.03757	9	.96379	8	32
29	.26696	28	.74591	393	.27701	31	.60996	408	.03766	8	.96371	8	31
30	0.26724	28	3.74198	392	0.27732	32	3.60588	407	1.03774	9	0.96363	8	30
31	.26752	28	.73806	392	.27764	31	.60181	406	.03783	8	.96355	8	29
32	.26780	28	.73414	390	.27795	31	.59775	405	.03791	8	.96347	7	28
33	.26808	28	.73024	389	.27826	32	.59370	404	.03799	9	.96340	8	27
34	.26836	28	.72635	389	.27858	31	.58966	404	.03808	8	.96332	8	26
35	0.26864	28	3.72246	388	0.27889	32	3.58562	402	1.03816	9	0.96324	8	25
36	.26892	28	.71858	387	.27921	31	.58160	402	.03825	8	.96316	8	24
37	.26920	28	.71471	386	.27952	31	.57758	401	.03833	9	.96308	7	23
38	.26948	28	.71085	385	.27983	32	.57357	400	.03842	8	.96301	8	22
39	.26976	28	.70700	385	.28015	31	.56957	400	.03850	8	.96293	8	21
40	0.27004	28	3.70315	384	0.28046	31	3.56557	398	1.03858	9	0.96285	8	20
41	.27032	28	.69931	382	.28077	32	.56159	398	.03867	8	.96277	8	19
42	.27060	28	.69549	382	.28109	31	.55761	397	.03875	9	.96269	8	18
43	.27088	28	.69167	382	.28140	32	.55364	396	.03884	8	.96261	8	17
44	.27116	28	.68785	380	.28172	31	.54968	395	.03892	9	.96253	7	16
45	0.27144	28	3.68405	380	0.28203	31	3.54573	394	1.03901	8	0.96246	8	15
46	.27172	28	.68025	378	.28234	32	.54179	394	.03909	9	.96238	8	14
47	.27200	28	.67647	378	.28266	31	.53785	392	.03918	9	.96230	8	13
48	.27228	28	.67269	377	.28297	32	.53393	392	.03927	8	.96222	8	12
49	.27256	28	.66892	377	.28329	31	.53001	392	.03935	9	.96214	8	11
50	0.27284	28	3.66515	375	0.28360	31	3.52609	390	1.03944	8	0.96206	8	10
51	.27312	28	.66140	375	.28391	32	.52219	390	.03952	9	.96198	8	9
52	.27340	28	.65765	374	.28423	31	.51829	388	.03961	8	.96190	8	8
53	.27368	28	.65391	373	.28454	32	.51441	388	.03969	9	.96182	8	7
54	.27396	28	.65018	373	.28486	31	.51053	387	.03978	8	.96174	8	6
55	0.27424	28	3.64645	371	0.28517	32	3.50666	387	1.03987	8	0.96166	8	5
56	.27452	28	.64274	371	.28549	31	.50279	385	.03995	9	.96158	8	4
57	.27480	28	.63903	370	.28580	32	.49894	385	.04004	9	.96150	8	3
58	.27508	28	.63533	369	.28612	31	.49509	384	.04013	8	.96142	8	2
59	.27536	28	.63164	368	.28643	32	.49125	384	.04021	9	.96134	8	1
60	0.27564	28	3.62796		0.28675		3.48741		1.04030		0.96126		0
↑105°	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	↑74°

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Natural Trigonometric Functions

16° ↑														Diff. 1'					
sin		Diff. 1'	csc		Diff. 1'	tan		Diff. 1'	cot		Diff. 1'	sec		Diff. 1'	cos		Diff. 1'		
0	0.27564	28	3.62796	368	0.28675	31	3.48741	382	1.04030	9	0.96126	8	60						
1	0.27592	28	62428	367	28706	32	48359	382	0.4039	8	96118	8	59						
2	0.27620	28	62061	366	28738	31	47977	381	0.4047	9	96110	8	58						
3	0.27648	28	61695	365	28769	32	47596	380	0.4056	9	96102	8	57						
4	0.27676	28	61330	365	28801	31	47216	379	0.4065	8	96094	8	56						
5	0.27704	27	60965	364	0.28832	32	46837	379	1.04073	9	0.96086	8	55						
6	0.27731	28	60601	363	28864	31	46458	378	0.4082	9	96078	8	54						
7	0.27759	28	60238	362	28895	32	46080	377	0.4091	9	96070	8	53						
8	0.27787	28	59876	362	28927	31	45703	376	0.4100	9	96062	8	52						
9	0.27815	28	59514	360	28958	32	45327	376	0.4108	8	96054	8	51						
10	0.27843	28	59154	360	0.28990	31	44951	375	1.04117	9	0.96046	8	50						
11	0.27871	28	58794	360	29021	32	44576	374	0.4126	9	96037	8	49						
12	0.27899	28	58434	358	29053	31	44202	373	0.4135	9	96029	8	48						
13	0.27927	28	58076	358	29084	32	43829	373	0.4144	8	96021	8	47						
14	0.27955	28	57718	357	29116	31	43456	372	0.4152	9	96013	8	46						
15	0.27983	28	57361	356	0.29147	32	43084	371	1.04161	9	0.96005	8	45						
16	0.28011	28	57005	356	29179	31	42713	370	0.4170	9	95997	8	44						
17	0.28039	28	56649	355	29210	32	42343	370	0.4179	9	95989	8	43						
18	0.28067	28	56294	354	29242	31	41973	369	0.4188	9	95981	8	42						
19	0.28095	28	55940	353	29274	32	41604	368	0.4197	9	95972	8	41						
20	0.28123	27	55587	353	0.29305	31	41236	368	1.04206	9	0.95964	8	40						
21	0.28150	28	55234	351	29337	32	40869	367	0.4214	9	95956	8	39						
22	0.28178	28	54883	352	29368	31	40502	366	0.4223	9	95948	8	38						
23	0.28206	28	54531	350	29400	32	40136	365	0.4232	9	95940	8	37						
24	0.28234	28	54181	350	29432	31	39771	365	0.4241	9	95931	8	36						
25	0.28262	28	53831	349	0.29463	32	39406	364	1.04250	9	0.95923	8	35						
26	0.28290	28	53482	348	29495	31	39042	363	0.4259	9	95915	8	34						
27	0.28318	28	53134	347	29526	32	38679	362	0.4268	9	95907	8	33						
28	0.28346	28	52787	347	29558	31	38317	362	0.4277	9	95898	8	32						
29	0.28374	28	52440	346	29590	32	37955	361	0.4286	9	95890	8	31						
30	0.28402	27	52094	346	0.29621	31	37594	360	1.04295	9	0.95882	8	30						
31	0.28429	28	51748	346	29653	32	37234	359	0.4304	9	95874	8	29						
32	0.28457	28	51404	344	29685	31	36875	359	0.4313	9	95865	8	28						
33	0.28485	28	51060	344	29716	32	36516	358	0.4322	9	95857	8	27						
34	0.28513	28	50716	342	29748	31	36158	358	0.4331	9	95849	8	26						
35	0.28541	28	50374	342	0.29780	32	35800	357	1.04340	9	0.95841	8	25						
36	0.28569	28	50032	341	29811	31	35443	356	0.4349	9	95832	8	24						
37	0.28597	28	49691	341	29843	32	35087	355	0.4358	9	95824	8	23						
38	0.28625	27	49350	340	29875	31	34732	355	0.4367	9	95816	8	22						
39	0.28652	28	49010	339	29906	32	34377	354	0.4376	9	95807	8	21						
40	0.28680	28	48671	338	0.29938	31	34023	353	1.04385	9	0.95799	8	20						
41	0.28708	28	48333	338	29970	32	33670	353	0.4394	9	95791	8	19						
42	0.28736	28	47995	337	30001	31	33317	352	0.4403	10	95782	8	18						
43	0.28764	28	47658	337	30033	32	32965	351	0.4413	9	95774	8	17						
44	0.28792	28	47321	335	30065	31	32614	350	0.4422	9	95766	8	16						
45	0.28820	27	46986	335	0.30097	32	32264	350	1.04431	9	0.95757	8	15						
46	0.28847	28	46651	335	30128	31	31914	349	0.4440	9	95749	8	14						
47	0.28875	28	46316	335	30160	32	31565	349	0.4449	9	95740	8	13						
48	0.28903	28	45983	333	30192	31	31216	348	0.4458	10	95732	8	12						
49	0.28931	28	45650	333	30224	32	30868	347	0.4468	9	95724	8	11						
50	0.28959	28	45317	331	0.30255	31	30521	347	1.04477	9	0.95715	8	10						
51	0.28987	28	44986	331	30287	32	30174	345	0.4486	9	95707	8	9						
52	0.29015	27	44655	331	30319	31	29829	345	0.4495	9	95698	8	8						
53	0.29042	28	44324	331	30351	32	29483	346	0.4504	10	95690	8	7						
54	0.29070	28	43995	329	30382	31	29139	344	0.4514	9	95681	8	6						
55	0.29098	28	43666	329	0.30414	32	28795	343	1.04523	9	0.95673	8	5						
56	0.29126	28	43337	327	30446	31	28452	343	0.4532	9	95664	8	4						
57	0.29154	28	43010	327	30478	32	28109	342	0.4541	10	95656	8	3						
58	0.29182	28	42683	327	30509	31	27767	341	0.4551	9	95647	8	2						
59	0.29209	27	42356	326	30541	32	27426	341	0.4560	9	95639	8	1						
60	0.29237	28	42030	326	0.30573	31	27085	341	1.04569	9	0.95630	8	0						
↑ 106° cos														Diff. 1'		↑ 73° sin		Diff. 1'	

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Natural Trigonometric Functions

$17^{\circ} \rightarrow$ \downarrow	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	$\leftarrow 162^{\circ}$
0	29237	3.42030	325	0.30573	32	3.27085	340	1.04569	9	0.95630	8	60
1	29265	4.1705	324	30605	32	26745	339	0.4578	10	95622	9	59
2	29293	4.1381	324	30637	32	26406	339	0.4588	9	95613	8	58
3	29321	4.1057	323	30669	31	26067	338	0.4597	9	95605	9	57
4	29348	4.0734	323	30700	31	25729	337	0.4606	10	95596	8	56
5	29376	3.40411	322	0.30732	32	3.25392	337	1.04616	9	0.95588	9	55
6	29404	4.0089	321	30764	32	25055	336	0.4625	10	95579	8	54
7	29432	3.9768	320	30796	32	24719	336	0.4635	9	95571	9	53
8	29460	3.9448	320	30828	32	24383	334	0.4644	9	95562	8	52
9	29487	3.9128	320	30860	31	24049	335	0.4653	10	95554	9	51
10	29515	3.38808	319	0.30891	32	3.23714	333	1.04663	9	0.95545	9	50
11	29543	3.38489	318	30923	32	23381	333	0.4672	10	95536	8	49
12	29571	3.38171	317	30955	32	23048	333	0.4682	9	95528	9	48
13	29599	3.37854	317	30987	32	22715	331	0.4691	9	95519	8	47
14	29626	3.37537	316	31019	32	22384	331	0.4700	10	95511	9	46
15	29654	3.37221	316	0.31051	32	3.22053	331	1.04710	9	0.95502	9	45
16	29682	3.36905	315	31083	32	21722	330	0.4719	10	95493	8	44
17	29710	3.36590	314	31115	32	21392	329	0.4729	9	95485	9	43
18	29737	3.36276	314	31147	31	21063	329	0.4738	10	95476	8	42
19	29765	3.35962	313	31178	32	20734	328	0.4748	9	95467	9	41
20	29793	3.35649	313	0.31210	32	3.20406	327	1.04757	10	0.95459	8	40
21	29821	3.35336	311	31242	32	20079	327	0.4767	9	95450	9	39
22	29849	3.35025	312	31274	32	19752	326	0.4776	10	95441	8	38
23	29876	3.34713	310	31306	32	19426	326	0.4786	9	95433	9	37
24	29904	3.34403	311	31338	32	19100	325	0.4795	10	95424	8	36
25	29932	3.34092	309	0.31370	32	3.18775	324	1.04805	9	0.95415	9	35
26	29960	3.33783	309	31402	32	18451	324	0.4815	9	95407	8	34
27	29987	3.33474	308	31434	32	18127	323	0.4824	10	95398	9	33
28	30015	3.33166	308	31466	32	17804	323	0.4834	9	95389	8	32
29	30043	3.32858	307	31498	32	17481	322	0.4843	10	95380	9	31
30	30071	3.32551	307	0.31530	32	3.17159	321	1.04853	9	0.95372	8	30
31	30098	3.32244	305	31562	32	16838	321	0.4863	9	95363	9	29
32	30126	3.31939	306	31594	32	16517	320	0.4872	10	95354	8	28
33	30154	3.31633	305	31626	32	16197	320	0.4882	9	95345	9	27
34	30182	3.31328	304	31658	32	15877	319	0.4891	10	95337	8	26
35	30209	3.31024	303	0.31690	32	3.15558	316	1.04901	9	0.95328	9	25
36	30237	3.30721	303	31722	32	15240	318	0.4911	9	95319	8	24
37	30265	3.30418	303	31754	32	14922	317	0.4920	10	95310	9	23
38	30292	3.30115	301	31786	32	14605	317	0.4930	9	95301	8	22
39	30320	3.29814	302	31818	32	14288	316	0.4940	10	95293	9	21
40	30348	3.29512	300	0.31850	32	3.13972	316	1.04950	9	0.95284	8	20
41	30376	3.29212	300	31882	32	13656	316	0.4959	10	95275	9	19
42	30403	3.28912	300	31914	32	13341	315	0.4969	9	95266	8	18
43	30431	3.28612	299	31946	32	13027	314	0.4979	10	95257	9	17
44	30459	3.28313	298	31978	32	12713	313	0.4989	9	95248	8	16
45	30486	3.28015	298	0.32010	32	3.12400	313	1.04908	10	0.95240	9	15
46	30514	3.27717	297	32042	32	12087	313	0.5008	9	95231	8	14
47	30542	3.27420	297	32074	32	11775	312	0.5018	10	95222	9	13
48	30570	3.27123	296	32106	33	11464	311	0.5028	9	95213	8	12
49	30597	3.26827	296	32139	32	11153	311	0.5038	10	95204	9	11
50	30625	3.26531	294	0.32171	32	3.10842	310	1.05047	9	0.95195	8	10
51	30653	3.26237	295	32203	32	10532	309	0.5057	10	95186	9	9
52	30680	3.25942	294	32235	32	10223	309	0.5067	9	95177	8	8
53	30708	3.25648	293	32267	32	9914	308	0.5077	10	95168	9	7
54	30736	3.25355	293	32299	32	9606	308	0.5087	9	95159	8	6
55	30763	3.25062	292	0.32331	32	3.09298	307	1.05097	10	0.95150	9	5
56	30791	3.24770	292	32363	33	08991	306	0.5107	9	95142	8	4
57	30819	3.24478	291	32396	32	08685	306	0.5116	10	95133	9	3
58	30846	3.24187	290	32428	32	08379	306	0.5126	9	95124	8	2
59	30874	3.23897	290	32460	32	08073	305	0.5136	10	95115	9	1
60	30902	3.23607	290	0.32492	32	3.07768	305	1.05146	9	0.95106	8	0
$\uparrow 107^{\circ} \rightarrow$ \cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	$\leftarrow 72^{\circ}$

Natural Trigonometric Functions

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18° ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	161° ↓
0	0.30902	27	3.23607	290	0.32492	32	3.07768	304	1.05146	10	0.95106	9	60
1	30929	28	23317	289	32524	32	07464	304	05156	10	95097	9	59
2	30957	28	23028	288	32556	32	07160	303	05166	10	95088	9	58
3	30985	27	22740	288	32588	33	06857	303	05176	10	95079	9	57
4	31012	28	22452	287	32621	32	06554	302	05186	10	95070	9	56
5	0.31040	28	3.22165	287	0.32653	32	3.06252	302	1.05196	10	0.95061	9	55
6	31068	27	21878	286	32685	32	05950	301	05206	10	95052	9	54
7	31095	28	21592	286	32717	32	05649	300	05216	10	95043	9	53
8	31123	28	21306	285	32749	33	05349	300	05226	10	95033	10	52
9	31151	27	21021	284	32782	32	05049	300	05236	10	95024	9	51
10	0.31178	28	3.20737	284	0.32814	32	3.04749	299	1.05246	10	0.95015	9	50
11	31206	27	20453	284	32846	32	04450	298	05256	10	95006	9	49
12	31233	28	20169	283	32878	32	04152	298	05266	10	94997	9	48
13	31261	28	19886	282	32911	33	03854	298	05276	10	94988	9	47
14	31289	27	19604	282	32943	32	03556	296	05286	11	94979	9	46
15	0.31316	28	3.19322	282	0.32975	32	3.03260	297	1.05297	10	0.94970	9	45
16	31344	28	19040	281	33007	33	02963	296	05307	10	94961	9	44
17	31372	27	18759	280	33040	32	02667	295	05317	10	94952	9	43
18	31399	28	18479	280	33072	32	02372	295	05327	10	94943	9	42
19	31427	27	18199	279	33104	32	02077	294	05337	10	94933	10	41
20	0.31454	28	3.17920	279	0.33136	33	3.01783	294	1.05347	10	0.94924	9	40
21	31482	28	17641	278	33169	32	01489	293	05357	10	94915	9	39
22	31510	27	17363	278	33201	32	01196	293	05367	10	94906	9	38
23	31537	28	17085	277	33233	33	00903	292	05378	11	94897	9	37
24	31565	28	16808	277	33266	32	00611	292	05388	10	94888	10	36
25	0.31593	27	3.16531	276	0.33298	32	3.00319	291	1.05398	10	0.94878	9	35
26	31620	28	16255	276	33330	33	3.00028	290	05408	10	94869	9	34
27	31648	27	15979	275	33363	32	2.99738	290	05418	10	94860	9	33
28	31675	28	15704	275	33395	32	99447	289	05429	11	94851	9	32
29	31703	27	15429	274	33427	33	99158	290	05439	10	94842	10	31
30	0.31730	28	3.15155	274	0.33460	32	2.98868	288	1.05449	10	0.94832	9	30
31	31758	28	14881	273	33492	32	98580	288	05459	11	94823	9	29
32	31786	27	14608	273	33524	33	98292	288	05470	10	94814	9	28
33	31813	28	14335	272	33557	32	98004	287	05480	10	94805	9	27
34	31841	27	14063	272	33589	32	97717	287	05490	11	94795	10	26
35	0.31868	28	3.13791	271	0.33621	33	2.97430	286	1.05501	10	0.94786	9	25
36	31896	27	13520	271	33654	32	97144	286	05511	10	94777	9	24
37	31923	28	13249	270	33686	32	96858	285	05521	10	94768	9	23
38	31951	28	12979	270	33718	33	96573	285	05532	11	94758	10	22
39	31979	27	12709	269	33751	32	96288	284	05542	10	94749	9	21
40	0.32006	28	3.12440	269	0.33783	33	2.96004	283	1.05552	11	0.94740	9	20
41	32034	27	12171	268	33816	32	95721	284	05563	10	94730	10	19
42	32061	28	11903	268	33848	33	95437	282	05573	10	94721	9	18
43	32089	27	11635	268	33881	32	95155	282	05584	11	94712	9	17
44	32116	28	11367	266	33913	32	94872	281	05594	10	94702	10	16
45	0.32144	27	3.11101	267	0.33945	33	2.94591	282	1.05604	11	0.94693	9	15
46	32171	28	10834	266	33978	32	94309	281	05615	10	94684	10	14
47	32199	28	10568	265	34010	33	94028	280	05625	11	94674	9	13
48	32227	27	10303	265	34043	32	93748	280	05636	10	94665	9	12
49	32254	28	10038	264	34075	33	93468	279	05646	11	94656	10	11
50	0.32282	27	3.09774	264	0.34108	32	2.93189	279	1.05657	10	0.94646	9	10
51	32309	28	09510	264	34140	33	92910	278	05667	11	94637	10	9
52	32337	27	09246	263	34173	32	92632	278	05678	10	94627	9	8
53	32364	28	08983	262	34205	33	92354	278	05688	11	94618	9	7
54	32392	27	08721	262	34238	32	92076	277	05699	10	94609	10	6
55	0.32419	28	3.08459	262	0.34270	33	2.91799	276	1.05709	11	0.94599	9	5
56	32447	27	08197	261	34303	32	91523	277	05720	10	94590	10	4
57	32474	28	07936	261	34335	33	91246	275	05730	11	94580	9	3
58	32502	27	07675	260	34368	32	90971	275	05741	10	94571	9	2
59	32529	28	07415	260	34400	33	90696	275	05751	11	94561	10	1
60	0.32557	28	3.07155	260	0.34433	32	2.90421	275	1.05762	11	0.94552	9	0
108° ↑	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	71° ↑

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Natural Trigonometric Functions

21° ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	+158° ↑
0	0.35837	27	2.79043	211	0.38386	34	2.60509	226	1.07114	12	0.93358	10	60
1	35864	27	78832	211	38420	33	60283	226	07126	12	93348	11	59
2	35891	27	78621	211	38453	34	60057	226	07138	12	93337	10	58
3	35918	27	78410	210	38487	33	59831	226	07150	12	93327	11	57
4	35945	28	78200	210	38520	33	59606	225	07162	12	93316	10	56
5	0.35973	27	2.77990	210	0.38553	34	2.59381	225	1.07174	12	0.93306	11	55
6	36000	27	77780	209	38587	33	59156	224	07186	13	93295	10	54
7	36027	27	77571	209	38620	34	58932	224	07199	12	93285	11	53
8	36054	27	77362	208	38654	33	58708	224	07211	12	93274	10	52
9	36081	27	77154	209	38687	34	58484	223	07223	12	93264	11	51
10	0.36108	27	2.76945	208	0.38721	33	2.58261	223	1.07235	12	0.93253	10	50
11	36135	27	76737	207	38754	33	58038	223	07247	12	93243	11	49
12	36162	28	76530	207	38787	34	57815	222	07259	12	93232	10	48
13	36190	27	76323	207	38821	33	57593	222	07271	12	93222	11	47
14	36217	27	76116	207	38854	34	57371	221	07283	12	93211	10	46
15	0.36244	27	2.75909	206	0.38888	33	2.57150	222	1.07295	12	0.93201	11	45
16	36271	27	75703	206	38921	34	56928	221	07307	13	93190	10	44
17	36298	27	75497	205	38955	33	56707	220	07320	12	93180	11	43
18	36325	27	75292	206	38988	34	56487	221	07332	12	93169	10	42
19	36352	27	75086	205	39022	33	56266	220	07344	12	93159	11	41
20	0.36379	27	2.74881	204	0.39055	34	2.56046	219	1.07356	12	0.93148	11	40
21	36406	28	74677	204	39089	33	55827	219	07368	12	93137	10	39
22	36434	27	74473	204	39122	34	55608	219	07380	13	93127	11	38
23	36461	27	74269	204	39156	34	55389	219	07393	12	93116	10	37
24	36488	27	74065	203	39190	33	55170	218	07405	12	93106	11	36
25	0.36515	27	2.73862	203	0.39223	34	2.54952	218	1.07417	12	0.93095	11	35
26	36542	27	73659	203	39257	33	54734	218	07429	13	93084	10	34
27	36569	27	73456	202	39290	34	54516	217	07442	12	93074	11	33
28	36596	27	73254	202	39324	33	54299	217	07454	12	93063	10	32
29	36623	27	73052	202	39357	34	54082	217	07466	13	93052	11	31
30	0.36650	27	2.72850	201	0.39391	34	2.53865	217	1.07479	12	0.93042	11	30
31	36677	27	72649	201	39425	33	53648	216	07491	12	93031	10	29
32	36704	27	72448	201	39458	34	53432	215	07503	13	93020	11	28
33	36731	27	72247	200	39492	34	53217	215	07516	12	93010	10	27
34	36758	27	72047	200	39526	33	53001	215	07528	12	92999	11	26
35	0.36785	27	2.71847	200	0.39559	34	2.52786	215	1.07540	13	0.92988	10	25
36	36812	27	71647	199	39593	33	52571	214	07553	12	92978	11	24
37	36839	28	71448	199	39626	34	52357	215	07565	13	92967	10	23
38	36867	27	71249	199	39660	34	52142	213	07578	12	92956	11	22
39	36894	27	71050	199	39694	33	51929	214	07590	12	92945	10	21
40	0.36921	27	2.70851	198	0.39727	34	2.51715	213	1.07602	13	0.92935	11	20
41	36948	27	70653	198	39761	34	51502	213	07615	12	92924	10	19
42	36975	27	70455	197	39795	34	51289	213	07627	13	92913	11	18
43	37002	27	70258	197	39829	33	51076	212	07640	12	92902	10	17
44	37029	27	70061	197	39862	34	50864	212	07652	13	92892	11	16
45	0.37056	27	2.69864	197	0.39896	34	2.50652	212	1.07665	12	0.92881	10	15
46	37083	27	69667	196	39930	33	50440	211	07677	13	92870	11	14
47	37110	27	69471	196	39963	34	50229	211	07690	12	92859	10	13
48	37137	27	69275	196	39997	34	50018	211	07702	13	92849	11	12
49	37164	27	69079	195	40031	34	49807	210	07715	12	92838	10	11
50	0.37191	27	2.68884	195	0.40065	33	2.49597	211	1.07727	13	0.92827	11	10
51	37218	27	68689	195	40098	34	49386	209	07740	12	92816	10	9
52	37245	27	68494	195	40132	34	49177	210	07752	13	92805	11	8
53	37272	27	68299	194	40166	34	48967	210	07765	12	92794	10	7
54	37299	27	68105	194	40200	33	48758	209	07777	13	92783	11	6
55	0.37326	27	2.67911	193	0.40234	33	2.48549	209	1.07790	13	0.92773	10	5
56	37353	27	67718	193	40267	34	48340	208	07803	12	92762	11	4
57	37380	27	67525	193	40301	34	48132	208	07816	13	92751	10	3
58	37407	27	67332	193	40335	34	47924	208	07828	12	92740	11	2
59	37434	27	67139	192	40369	34	47716	207	07841	13	92729	10	1
60	0.37461	27	2.66947	192	0.40403	34	2.47509	207	1.07853	12	0.92718	11	0
↑ 111°	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	↑ 68°

Natural Trigonometric Functions

(36)

22° ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	↑157°
0	0.37461	27	2.66947	192	0.40403	33	2.47509	207	1.07853	13	0.92718	11	60
1	37488	27	66755	192	40436	34	47302	207	07866	13	92707	10	59
2	37515	27	66563	192	40470	34	47095	207	07879	13	92697	11	58
3	37542	27	66371	191	40504	34	46888	206	07892	13	92686	11	57
4	37569	26	66180	191	40538	34	46682	206	07904	13	92675	11	56
5	0.37595	27	2.65989	190	0.40572	34	2.46476	206	1.07917	13	0.92664	11	55
6	37622	27	65799	190	40606	34	46270	205	07930	13	92653	11	54
7	37649	27	65609	190	40640	34	46065	205	07943	13	92642	11	53
8	37676	27	65419	190	40674	33	45860	205	07955	13	92631	11	52
9	37703	27	65229	189	40707	34	45655	204	07968	13	92620	11	51
10	0.37730	27	2.65040	189	0.40741	34	2.45451	205	1.07981	13	0.92609	11	50
11	37757	27	64851	189	40775	34	45246	203	07994	12	92598	11	49
12	37784	27	64662	189	40809	34	45043	204	08006	13	92587	11	48
13	37811	27	64473	188	40843	34	44839	203	08019	13	92576	11	47
14	37838	27	64285	188	40877	34	44636	203	08032	13	92565	11	46
15	0.37865	27	2.64097	188	0.40911	34	2.44433	203	1.08045	13	0.92554	11	45
16	37892	27	63909	187	40945	34	44230	203	08058	13	92543	11	44
17	37919	27	63722	187	40979	34	44027	202	08071	13	92532	11	43
18	37946	27	63535	187	41013	34	43825	202	08084	13	92521	11	42
19	37973	26	63348	186	41047	34	43623	201	08097	12	92510	11	41
20	0.37999	27	2.63162	186	0.41081	34	2.43422	202	1.08109	13	0.92499	11	40
21	38026	27	62976	186	41115	34	43220	201	08122	13	92488	11	39
22	38053	27	62790	186	41149	34	43019	200	08135	13	92477	11	38
23	38080	27	62604	185	41183	34	42819	201	08148	13	92466	11	37
24	38107	27	62419	185	41217	34	42618	200	08161	13	92455	11	36
25	0.38134	27	2.62234	185	0.41251	34	2.42418	200	1.08174	13	0.92444	12	35
26	38161	27	62049	185	41285	34	42218	199	08187	13	92432	11	34
27	38188	27	61864	184	41319	34	42019	200	08200	13	92421	11	33
28	38215	26	61680	184	41353	34	41819	199	08213	13	92410	11	32
29	38241	27	61496	183	41387	34	41620	199	08226	13	92399	11	31
30	0.38268	27	2.61313	184	0.41421	34	2.41421	198	1.08239	13	0.92388	11	30
31	38295	27	61129	183	41455	35	41223	198	08252	13	92377	11	29
32	38322	27	60946	183	41490	34	41025	198	08265	13	92366	11	28
33	38349	27	60763	182	41524	34	40827	198	08278	13	92355	12	27
34	38376	27	60581	182	41558	34	40629	197	08291	14	92343	11	26
35	0.38403	27	2.60399	182	0.41592	34	2.40432	197	1.08305	13	0.92332	11	25
36	38430	26	60217	182	41626	34	40235	197	08318	13	92321	11	24
37	38456	27	60035	182	41660	34	40038	197	08331	13	92310	11	23
38	38483	27	59853	181	41694	34	39841	196	08344	13	92299	12	22
39	38510	27	59672	181	41728	35	39645	196	08357	13	92287	11	21
40	0.38537	27	2.59491	180	0.41763	34	2.39449	196	1.08370	13	0.92276	11	20
41	38564	27	59311	181	41797	34	39253	195	08383	14	92265	11	19
42	38591	26	59130	180	41831	34	39058	195	08397	13	92254	11	18
43	38617	27	58950	179	41865	34	38863	195	08410	13	92243	12	17
44	38644	27	58771	180	41899	34	38668	195	08423	13	92231	11	16
45	0.38671	27	2.58591	179	0.41933	35	2.38473	194	1.08436	13	0.92220	11	15
46	38698	27	58412	179	41968	34	38279	195	08449	14	92209	11	14
47	38725	27	58233	179	42002	34	38084	193	08463	13	92198	12	13
48	38752	26	58054	178	42036	34	37891	194	08476	13	92186	11	12
49	38778	27	57876	178	42070	35	37697	193	08489	14	92175	11	11
50	0.38805	27	2.57698	178	0.42105	34	2.37504	193	1.08503	13	0.92164	12	10
51	38832	27	57520	178	42139	34	37311	193	08516	13	92152	11	9
52	38859	27	57342	177	42173	34	37118	193	08529	13	92141	11	8
53	38886	26	57165	177	42207	35	36925	192	08542	14	92130	11	7
54	38912	27	56988	177	42242	34	36733	192	08556	13	92119	12	6
55	0.38939	27	2.56811	177	0.42276	34	2.36541	192	1.08569	13	0.92107	11	5
56	38966	27	56634	176	42310	35	36349	191	08582	14	92096	11	4
57	38993	27	56458	176	42345	34	36158	191	08596	13	92085	12	3
58	39020	26	56282	176	42379	34	35967	191	08609	14	92073	11	2
59	39046	27	56106	176	42413	34	35776	191	08623	13	92062	12	1
60	0.39073	27	2.55930	176	0.42447	34	2.35585	191	1.08636	13	0.92050	12	0
↑112°	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	↑67°

(36)

Natural Trigonometric Functions

23° ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	←156° ↓
0	0.39073	27	2.55930	175	0.42447	35	2.35585	190	1.08636	13	0.92050	11	60
1	39100	27	55755	175	42482	34	35395	190	08649	14	92039	11	59
2	39127	26	55580	175	42516	35	35205	190	08663	13	92078	12	58
3	39153	27	55405	174	42551	34	35015	190	08676	14	92016	11	57
4	39180	27	55231	174	42585	34	34825	189	08690	13	92005	11	56
5	0.39207	27	2.55057	174	0.42619	35	2.34636	189	1.08703	14	0.91994	12	55
6	39234	26	54883	174	42654	34	34447	189	08717	13	91982	11	54
7	39260	27	54709	173	42689	34	34258	189	08730	14	91971	12	53
8	39287	27	54536	173	42722	35	34069	188	08744	13	91959	11	52
9	39314	27	54363	173	42757	34	33881	188	08757	14	91948	12	51
10	0.39341	26	2.54190	173	0.42791	35	2.33693	188	1.08771	13	0.91936	11	50
11	39367	27	54017	172	42826	34	33505	188	08784	14	91925	11	49
12	39394	27	53845	173	42860	34	33317	187	08798	13	91914	12	48
13	39421	27	53672	172	42894	35	33130	187	08811	14	91902	11	47
14	39448	26	53500	171	42929	34	32943	187	08825	14	91891	12	46
15	0.39474	27	2.53329	172	0.42963	35	2.32756	186	1.08839	13	0.91879	11	45
16	39501	27	53157	171	42998	34	32570	187	08852	14	91868	12	44
17	39528	27	52986	171	43032	35	32383	186	08866	14	91856	11	43
18	39555	26	52815	170	43067	34	32197	185	08880	13	91845	12	42
19	39581	27	52645	171	43101	35	32012	186	08893	14	91833	11	41
20	0.39608	27	2.52474	170	0.43136	34	2.31826	185	1.08907	13	0.91822	12	40
21	39635	26	52304	170	43170	35	31641	185	08920	14	91810	11	39
22	39661	27	52134	169	43205	34	31456	185	08934	14	91799	12	38
23	39688	27	51965	170	43239	35	31271	185	08948	14	91787	12	37
24	39715	26	51795	169	43274	34	31086	184	08962	13	91775	11	36
25	0.39741	27	2.51626	169	0.43308	35	2.30902	184	1.08975	14	0.91764	12	35
26	39768	27	51457	168	43343	35	30718	184	08989	14	91752	11	34
27	39795	27	51289	169	43378	34	30534	184	09003	14	91741	12	33
28	39822	27	51120	168	43412	35	30351	183	09017	13	91729	11	32
29	39848	26	50952	168	43447	34	30167	183	09030	14	91718	12	31
30	0.39875	27	2.50784	167	0.43481	35	2.29984	183	1.09044	14	0.91706	12	30
31	39902	26	50617	168	43516	34	29801	182	09058	14	91694	11	29
32	39928	27	50449	167	43550	35	29619	182	09072	14	91683	12	28
33	39955	27	50282	167	43585	35	29437	183	09086	13	91671	11	27
34	39982	26	50115	167	43620	34	29254	181	09099	14	91660	12	26
35	0.40008	27	2.49948	166	0.43654	35	2.29073	182	1.09113	14	0.91648	12	25
36	40035	27	49782	166	43689	35	28891	181	09127	14	91636	11	24
37	40062	26	49616	166	43724	34	28710	182	09141	14	91625	12	23
38	40088	27	49450	166	43758	35	28528	180	09155	14	91613	12	22
39	40115	26	49284	165	43793	35	28348	181	09169	14	91601	11	21
40	0.40141	27	2.49119	165	0.43828	34	2.28167	180	1.09183	14	0.91590	12	20
41	40168	27	48954	165	43862	35	27987	181	09197	14	91578	12	19
42	40195	26	48789	165	43897	35	27806	180	09211	13	91566	11	18
43	40221	27	48624	165	43932	34	27626	179	09224	14	91555	12	17
44	40248	27	48459	164	43966	35	27447	180	09238	14	91543	12	16
45	0.40275	26	2.48295	164	0.44001	35	2.27267	179	1.09252	14	0.91531	12	15
46	40301	27	48131	164	44036	35	27088	179	09266	14	91519	11	14
47	40328	27	47967	163	44071	34	26909	179	09280	14	91508	12	13
48	40355	26	47804	164	44105	35	26730	178	09294	14	91496	12	12
49	40381	27	47640	163	44140	35	26552	178	09308	15	91484	12	11
50	0.40408	26	2.47477	163	0.44175	35	2.26374	178	1.09323	14	0.91472	11	10
51	40434	27	47314	162	44210	34	26196	178	09337	14	91461	12	9
52	40461	27	47152	163	44244	35	26018	178	09351	14	91449	12	8
53	40488	26	46989	162	44279	35	25840	177	09365	14	91437	12	7
54	40514	27	46827	162	44314	35	25663	177	09379	14	91425	11	6
55	0.40541	26	2.46665	161	0.44349	35	2.25486	177	1.09393	14	0.91414	12	5
56	40567	27	46504	162	44384	34	25309	177	09407	14	91402	12	4
57	40594	27	46342	161	44418	35	25132	176	09421	14	91390	12	3
58	40621	26	46181	161	44453	35	24956	176	09435	14	91378	12	2
59	40647	27	46020	161	44488	35	24780	176	09449	15	91366	11	1
60	0.40674	27	2.45859	161	0.44523	35	2.24604	176	1.09464	15	0.91355	11	0
↑113°	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	↑66°

Natural Trigonometric Functions

24° ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	155° ↑
0	0.40674	26	2.45859	160	0.44523	35	2.24604	176	1.09464	14	0.91355	12	60
1	40700	27	45699	160	44558	35	24428	176	09478	14	91343	12	59
2	40727	27	45539	161	44593	34	24252	175	09492	14	91331	12	58
3	40753	26	45378	159	44627	35	24077	175	09506	14	91319	12	57
4	40780	26	45219	160	44662	35	23902	175	09520	15	91307	12	56
5	0.40806	27	2.45059	159	0.44697	35	2.23727	174	1.09535	14	0.91295	12	55
6	40833	27	44900	159	44732	35	23553	175	09549	14	91283	11	54
7	40860	27	44741	159	44767	35	23378	174	09563	14	91272	12	53
8	40886	26	44582	159	44802	35	23204	174	09577	15	91260	12	52
9	40913	26	44423	159	44837	35	23030	173	09592	14	91248	12	51
10	0.40939	27	2.44264	158	0.44872	35	2.22857	174	1.09606	14	0.91236	12	50
11	40966	26	44106	158	44907	35	22683	173	09620	15	91224	12	49
12	40992	27	43948	158	44942	35	22510	173	09635	14	91212	12	48
13	41019	26	43790	157	44977	35	22337	173	09649	14	91200	12	47
14	41045	27	43633	157	45012	35	22164	172	09663	15	91188	12	46
15	0.41072	26	2.43476	158	0.45047	35	2.21992	173	1.09678	14	0.91176	12	45
16	41098	27	43318	156	45082	35	21819	172	09692	15	91164	12	44
17	41125	26	43162	157	45117	35	21647	172	09707	14	91152	12	43
18	41151	27	43005	157	45152	35	21475	171	09721	14	91140	12	42
19	41178	26	42848	156	45187	35	21304	172	09735	15	91128	12	41
20	0.41204	27	2.42692	156	0.45222	35	2.21132	171	1.09750	14	0.91116	12	40
21	41231	26	42536	156	45257	35	20961	171	09764	15	91104	12	39
22	41257	27	42380	155	45292	35	20790	171	09779	14	91092	12	38
23	41284	26	42225	155	45327	35	20619	170	09793	15	91080	12	37
24	41310	27	42070	156	45362	35	20449	171	09808	14	91068	12	36
25	0.41337	26	2.41914	154	0.45397	35	2.20278	170	1.09822	15	0.91056	12	35
26	41363	27	41760	155	45432	35	20108	170	09837	14	91044	12	34
27	41390	26	41605	155	45467	35	19938	169	09851	15	91032	12	33
28	41416	27	41450	154	45502	36	19769	170	09866	14	91020	12	32
29	41443	26	41296	154	45538	35	19599	169	09880	15	91008	12	31
30	0.41469	27	2.41142	154	0.45573	35	2.19430	169	1.09895	14	0.90996	12	30
31	41496	26	40988	153	45608	35	19261	169	09909	15	90984	12	29
32	41522	27	40835	154	45643	35	19092	169	09924	15	90972	12	28
33	41549	26	40681	153	45678	35	18923	168	09939	14	90960	12	27
34	41575	27	40528	153	45713	35	18755	168	09953	15	90948	12	26
35	0.41602	26	2.40375	153	0.45748	36	2.18587	168	1.09968	14	0.90936	12	25
36	41628	27	40222	152	45784	35	18419	168	09982	15	90924	13	24
37	41655	26	40070	152	45819	35	18251	167	09997	15	90911	12	23
38	41681	26	39918	152	45854	35	18084	168	10012	15	90899	12	22
39	41707	27	39766	152	45889	35	17916	167	10026	15	90887	12	21
40	0.41734	26	2.39614	152	0.45924	36	2.17749	167	1.10041	15	0.90875	12	20
41	41760	27	39462	151	45960	35	17582	166	10056	15	90863	12	19
42	41787	26	39311	152	45995	35	17416	167	10071	14	90851	12	18
43	41813	27	39159	151	46030	35	17249	166	10085	15	90839	13	17
44	41840	26	39008	151	46065	36	17083	166	10100	15	90826	12	16
45	0.41866	26	2.38857	150	0.46101	35	2.16917	166	1.10115	15	0.90814	12	15
46	41892	27	38707	151	46136	35	16751	166	10130	14	90802	12	14
47	41919	26	38556	150	46171	35	16585	165	10144	15	90790	12	13
48	41945	27	38406	150	46206	36	16420	165	10159	15	90778	12	12
49	41972	26	38256	150	46242	35	16255	165	10174	15	90766	13	11
50	0.41998	26	2.38106	149	0.46277	35	2.16090	165	1.10189	15	0.90753	12	10
51	42024	27	37957	149	46312	36	15925	165	10204	14	90741	12	9
52	42051	26	37808	150	46348	35	15760	164	10218	15	90729	12	8
53	42077	27	37658	149	46383	35	15596	164	10233	15	90717	13	7
54	42104	26	37509	148	46418	36	15432	164	10248	15	90704	12	6
55	0.42130	26	2.37361	149	0.46454	35	2.15268	164	1.10263	15	0.90692	12	5
56	42156	27	37212	148	46489	36	15104	164	10278	15	90680	12	4
57	42183	26	37064	148	46525	35	14940	163	10293	15	90668	13	3
58	42209	26	36916	148	46560	35	14777	163	10308	15	90655	12	2
59	42235	27	36768	148	46595	36	14614	163	10323	15	90643	12	1
60	0.42262	27	2.36620	148	0.46631	36	2.14451	163	1.10338	15	0.90631	12	0
↑ 114°	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	↑ 65°

(36)

Natural Trigonometric Functions

25° ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	154° ↓
0	0.42262	26	2.36620	147	0.46631	35	2.14451	163	1.10338	15	0.90631	13	60
1	42288	27	36473	148	46666	36	14288	163	10353	15	90618	12	59
2	42315	26	36325	147	46702	35	14125	162	10368	15	90606	12	58
3	42341	26	36178	147	46737	35	13963	162	10383	15	90594	12	57
4	42367	27	36031	146	46772	36	13801	162	10398	15	90582	12	56
5	0.42394	26	2.35885	147	0.46808	35	2.13639	162	1.10413	15	0.90569	12	55
6	42420	26	35738	146	46843	36	13477	161	10428	15	90557	12	54
7	42446	27	35592	146	46879	35	13316	162	10443	15	90545	13	53
8	42473	26	35446	146	46914	36	13154	161	10458	15	90532	12	52
9	42499	26	35300	146	46950	35	12993	161	10473	15	90520	12	51
10	0.42525	27	2.35154	145	0.46985	36	2.12832	161	1.10488	15	0.90507	12	50
11	42552	26	35009	146	47021	35	12671	160	10503	15	90495	12	49
12	42578	26	34863	145	47056	36	12511	161	10518	15	90483	13	48
13	42604	27	34718	145	47092	36	12350	160	10533	16	90470	12	47
14	42631	26	34573	144	47128	35	12190	160	10549	15	90458	12	46
15	0.42657	26	2.34429	145	0.47163	36	2.12030	159	1.10564	15	0.90446	13	45
16	42683	26	34284	144	47199	35	11871	160	10579	15	90433	12	44
17	42709	27	34140	144	47234	36	11711	159	10594	15	90421	13	43
18	42736	26	33996	144	47270	35	11552	160	10609	16	90408	12	42
19	42762	26	33852	144	47305	36	11392	159	10625	15	90396	13	41
20	0.42788	27	2.33708	143	0.47341	36	2.11233	158	1.10640	15	0.90383	12	40
21	42815	26	33565	143	47377	35	11075	159	10655	15	90371	13	39
22	42841	26	33422	144	47412	36	10916	158	10670	16	90358	12	38
23	42867	27	33278	143	47448	35	10758	158	10686	16	90346	12	37
24	42894	26	33135	142	47483	36	10600	158	10701	15	90334	13	36
25	0.42920	26	2.32993	143	0.47519	36	2.10442	158	1.10716	15	0.90321	12	35
26	42946	26	32850	142	47555	35	10284	158	10731	16	90309	13	34
27	42972	27	32708	142	47590	36	10126	157	10747	15	90296	12	33
28	42999	26	32566	142	47626	36	99969	158	10762	15	90284	13	32
29	43025	26	32424	142	47662	36	99811	157	10777	16	90271	12	31
30	0.43051	26	2.32282	142	0.47698	35	2.09654	156	1.10793	15	0.90259	13	30
31	43077	27	32140	141	47733	36	99498	157	10808	16	90246	13	29
32	43104	26	31999	141	47769	36	99341	157	10824	15	90233	13	28
33	43130	26	31858	141	47805	35	99184	156	10839	15	90221	12	27
34	43156	26	31717	141	47840	36	99028	156	10854	16	90208	13	26
35	0.43182	27	2.31576	140	0.47876	36	2.08872	156	1.10870	15	0.90196	13	25
36	43209	26	31436	141	47912	36	98716	156	10885	16	90183	12	24
37	43235	26	31295	140	47948	36	98560	155	10901	15	90171	13	23
38	43261	26	31155	140	47984	35	98405	155	10916	16	90158	12	22
39	43287	26	31015	140	48019	36	98250	156	10932	15	90146	13	21
40	0.43313	27	2.30875	140	0.48055	36	2.08094	155	1.10947	16	0.90133	13	20
41	43340	26	30735	139	48091	36	97939	154	10963	15	90120	12	19
42	43366	26	30596	139	48127	36	97785	155	10978	16	90108	13	18
43	43392	26	30457	139	48163	35	97630	154	10994	15	90095	13	17
44	43418	27	30318	139	48198	36	97476	155	11009	16	90082	12	16
45	0.43445	26	2.30179	139	0.48234	36	2.07321	154	1.11025	16	0.90070	13	15
46	43471	26	30040	139	48270	36	97167	153	11041	15	90057	12	14
47	43497	26	29901	138	48306	36	97014	154	11056	16	90045	13	13
48	43523	26	29763	138	48342	36	96860	154	11072	15	90032	13	12
49	43549	26	29625	138	48378	36	96706	153	11087	16	90019	12	11
50	0.43575	27	2.29487	138	0.48414	36	2.06553	153	1.11103	16	0.90007	13	10
51	43602	26	29349	138	48450	36	96400	153	11119	15	89994	13	9
52	43628	26	29211	137	48486	35	96247	153	11134	16	89981	13	8
53	43654	26	29074	137	48521	36	96094	152	11150	16	89968	12	7
54	43680	26	28937	137	48557	36	95942	152	11166	15	89956	13	6
55	0.43706	27	2.28800	137	0.48593	36	2.05790	153	1.11181	16	0.89943	13	5
56	43733	26	28663	137	48629	36	95637	152	11197	16	89930	12	4
57	43759	26	28526	136	48665	36	95485	152	11213	16	89918	13	3
58	43785	26	28390	137	48701	36	95333	151	11229	15	89905	13	2
59	43811	26	28253	136	48737	36	95182	152	11244	16	89892	13	1
60	0.43837	26	2.28117	136	0.48773	36	2.05030	152	1.11260	16	0.89879	13	0
115° ↑	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	64° ↑

Natural Trigonometric Functions

$26^{\circ} \rightarrow$ \uparrow	\sin	Diff. 1'	csc	Diff. 1'	\tan	Diff. 1'	cot	Diff. 1'	\tan	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	$\rightarrow 153^{\circ}$ \uparrow
0	0.43837	26	2.28117	136	0.48773	36	2.05030	151	1.11260	16	0.89879	12	0.89879	12	60
1	0.43863	26	2.27981	136	0.48809	36	0.4879	151	1.1276	16	0.89867	13	0.89867	13	59
2	0.43889	27	2.27845	136	0.48845	36	0.47728	151	1.1292	16	0.89854	13	0.89854	13	58
3	0.43910	26	2.27710	136	0.48881	36	0.45777	151	1.1308	15	0.89841	13	0.89841	13	57
4	0.43942	26	2.27574	135	0.48917	36	0.4426	150	1.1323	16	0.89828	12	0.89828	12	56
5	0.43968	26	2.27439	135	0.48953	36	2.04276	151	1.1339	16	0.89816	13	0.89816	13	55
6	0.43994	26	2.27304	135	0.48989	37	0.4125	150	1.1355	16	0.89803	13	0.89803	13	54
7	0.44020	26	2.27169	134	0.49026	36	0.3975	150	1.1371	16	0.89790	13	0.89790	13	53
8	0.44046	26	2.27035	134	0.49062	36	0.3825	150	1.1387	16	0.89777	13	0.89777	13	52
9	0.44072	26	2.26900	134	0.49098	36	0.3675	149	1.1403	16	0.89764	13	0.89764	13	51
10	0.44098	26	2.26766	134	0.49134	36	2.03526	150	1.1419	16	0.89752	12	0.89752	12	50
11	0.44124	27	2.26632	134	0.49170	36	0.3376	149	1.1435	16	0.89739	13	0.89739	13	49
12	0.44151	26	2.26498	134	0.49206	36	0.3227	149	1.1451	16	0.89726	13	0.89726	13	48
13	0.44177	26	2.26364	134	0.49242	36	0.3078	149	1.1467	16	0.89713	13	0.89713	13	47
14	0.44203	26	2.26230	133	0.49278	37	0.2929	149	1.1483	16	0.89700	13	0.89700	13	46
15	0.44229	26	2.26097	134	0.49315	36	2.02780	149	1.1499	16	0.89687	13	0.89687	13	45
16	0.44255	26	2.25963	133	0.49351	36	0.2631	148	1.1515	16	0.89674	12	0.89674	12	44
17	0.44281	26	2.25830	133	0.49387	36	0.2483	148	1.1531	16	0.89662	13	0.89662	13	43
18	0.44307	26	2.25697	132	0.49423	36	0.2335	148	1.1547	16	0.89649	13	0.89649	13	42
19	0.44333	26	2.25565	133	0.49459	36	0.2187	148	1.1563	16	0.89636	13	0.89636	13	41
20	0.44359	26	2.25432	132	0.49495	37	2.02039	148	1.1579	16	0.89623	13	0.89623	13	40
21	0.44385	26	2.25300	133	0.49532	36	0.1891	148	1.1595	16	0.89610	13	0.89610	13	39
22	0.44411	26	2.25167	132	0.49568	36	0.1743	147	1.1611	16	0.89597	13	0.89597	13	38
23	0.44437	26	2.25035	132	0.49604	36	0.1596	147	1.1627	16	0.89584	13	0.89584	13	37
24	0.44464	26	2.24903	131	0.49640	37	0.1449	147	1.1643	16	0.89571	13	0.89571	13	36
25	0.44490	26	2.24772	132	0.49677	36	2.01302	147	1.1659	16	0.89558	13	0.89558	13	35
26	0.44516	26	2.24640	131	0.49713	36	0.1155	147	1.1675	16	0.89545	13	0.89545	13	34
27	0.44542	26	2.24508	131	0.49749	37	0.1008	146	1.1691	17	0.89532	13	0.89532	13	33
28	0.44568	26	2.24378	131	0.49786	37	0.0862	147	1.1708	16	0.89519	13	0.89519	13	32
29	0.44594	26	2.24247	131	0.49822	36	0.0715	146	1.1724	16	0.89506	13	0.89506	13	31
30	0.44620	26	2.24116	131	0.49858	36	2.00523	146	1.1740	16	0.89493	13	0.89493	13	30
31	0.44646	26	2.23985	130	0.49894	36	0.0423	146	1.1756	16	0.89480	13	0.89480	13	29
32	0.44672	26	2.23855	130	0.49931	36	0.0277	146	1.1772	17	0.89467	13	0.89467	13	28
33	0.44698	26	2.23724	130	0.49967	37	2.00131	145	1.1789	16	0.89454	13	0.89454	13	27
34	0.44724	26	2.23594	130	0.50004	36	1.99986	145	1.1805	16	0.89441	13	0.89441	13	26
35	0.44750	26	2.23464	130	0.50040	36	1.99841	146	1.1821	17	0.89428	13	0.89428	13	25
36	0.44776	26	2.23334	129	0.50076	37	0.99695	145	1.1838	16	0.89415	13	0.89415	13	24
37	0.44802	26	2.23205	129	0.50113	36	0.99550	144	1.1854	16	0.89402	13	0.89402	13	23
38	0.44828	26	2.23075	129	0.50149	36	0.99406	145	1.1870	16	0.89389	13	0.89389	13	22
39	0.44854	26	2.22946	129	0.50185	37	0.99261	145	1.1886	17	0.89376	13	0.89376	13	21
40	0.44880	26	2.22817	129	0.50222	36	1.99116	144	1.1903	16	0.89363	13	0.89363	13	20
41	0.44906	26	2.22688	129	0.50258	36	0.89972	144	1.1919	17	0.89350	13	0.89350	13	19
42	0.44932	26	2.22559	129	0.50295	37	0.88828	144	1.1936	16	0.89337	13	0.89337	13	18
43	0.44958	26	2.22430	128	0.50331	36	0.88684	144	1.1952	16	0.89324	13	0.89324	13	17
44	0.44984	26	2.22302	128	0.50368	36	1.98540	144	1.1968	17	0.89311	13	0.89311	13	16
45	0.45010	26	2.22174	129	0.50404	37	1.98396	143	1.1985	16	0.89298	13	0.89298	13	15
46	0.45036	26	2.22045	127	0.50441	36	0.98253	143	1.2001	17	0.89285	13	0.89285	13	14
47	0.45062	26	2.21918	128	0.50477	37	0.98110	143	1.2018	16	0.89272	13	0.89272	13	13
48	0.45088	26	2.21790	128	0.50514	36	0.97966	143	1.2034	17	0.89259	14	0.89259	14	12
49	0.45114	26	2.21662	127	0.50550	37	0.97823	142	1.2051	16	0.89245	13	0.89245	13	11
50	0.45140	26	2.21535	128	0.50587	36	1.97681	143	1.2067	16	0.89232	13	0.89232	13	10
51	0.45166	26	2.21407	127	0.50623	37	0.97538	143	1.2083	17	0.89219	13	0.89219	13	9
52	0.45192	26	2.21280	127	0.50660	36	0.97395	142	1.2100	17	0.89206	13	0.89206	13	8
53	0.45218	25	2.21153	127	0.50696	37	0.97253	142	1.2117	16	0.89193	13	0.89193	13	7
54	0.45243	25	2.21026	126	0.50733	36	0.97111	142	1.2133	17	0.89180	13	0.89180	13	6
55	0.45269	26	2.20900	127	0.50769	37	1.96969	142	1.2150	16	0.89167	14	0.89167	14	5
56	0.45295	26	2.20773	126	0.50806	37	0.96827	142	1.2166	17	0.89153	13	0.89153	13	4
57	0.45321	26	2.20647	126	0.50843	36	0.96685	141	1.2183	16	0.89140	13	0.89140	13	3
58	0.45347	26	2.20521	126	0.50879	37	0.96544	142	1.2199	17	0.89127	13	0.89127	13	2
59	0.45373	26	2.20395	126	0.50916	37	0.96402	141	1.2216	17	0.89114	13	0.89114	13	1
60	0.45399	26	2.20269	126	0.50953	37	1.96261	141	1.2233	17	0.89101	13	0.89101	13	0

 $\uparrow 116^{\circ} \rightarrow \cos$

(36)

Natural Trigonometric Functions

27° ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	+152° ↓
0	0.45399	26	2.20269	126	0.50953	36	1.96261	141	1.12233	16	0.89101	14	60
1	.45425	26	.20143	125	.50989	37	.96120	141	.12249	17	.89087	13	59
2	.45451	26	.20018	126	.51026	37	.95979	141	.12266	17	.89074	13	58
3	.45477	26	.19892	125	.51063	36	.95838	140	.12283	16	.89061	13	57
4	.45503	26	.19767	125	.51099	37	.95698	141	.12299	17	.89048	13	56
5	0.45529	25	2.19642	125	0.51136	37	1.95557	140	1.12316	17	0.89035	14	55
6	.45554	26	.19517	124	.51173	36	.95417	140	.12333	16	.89021	13	54
7	.45580	26	.19393	125	.51209	37	.95277	140	.12349	17	.89008	13	53
8	.45606	26	.19268	124	.51246	37	.95137	140	.12366	17	.88995	14	52
9	.45632	26	.19144	125	.51283	36	.94997	139	.12383	17	.88981	13	51
10	0.45658	26	2.19019	124	0.51319	37	1.94858	140	1.12400	16	0.88968	13	50
11	.45684	26	.18895	123	.51356	37	.94718	139	.12416	17	.88955	13	49
12	.45710	26	.18772	124	.51393	37	.94579	139	.12433	17	.88942	14	48
13	.45736	26	.18648	124	.51430	37	.94440	139	.12450	17	.88928	13	47
14	.45762	25	.18524	123	.51467	36	.94301	139	.12467	17	.88915	13	46
15	0.45787	26	2.18401	124	0.51503	37	1.94162	139	1.12484	17	0.88902	14	45
16	.45813	26	.18277	123	.51540	37	.94023	138	.12501	17	.88888	13	44
17	.45839	26	.18154	123	.51577	37	.93885	139	.12518	16	.88875	13	43
18	.45865	26	.18031	122	.51614	37	.93746	138	.12534	17	.88862	14	42
19	.45891	26	.17909	123	.51651	37	.93608	138	.12551	17	.88848	13	41
20	0.45917	25	2.17780	123	0.51688	36	1.93470	138	1.12568	17	0.88835	13	40
21	.45942	26	.17663	122	.51724	37	.93332	137	.12585	17	.88822	14	39
22	.45968	26	.17541	122	.51761	37	.93195	138	.12602	17	.88808	13	38
23	.45994	26	.17419	122	.51798	37	.93057	137	.12619	17	.88795	13	37
24	.46020	26	.17297	122	.51835	37	.92920	138	.12636	17	.88782	14	36
25	0.46046	26	2.17175	122	0.51872	37	1.92782	137	1.12653	17	0.88768	13	35
26	.46072	25	.17053	121	.51909	37	.92645	137	.12670	17	.88755	14	34
27	.46097	26	.16932	122	.51946	37	.92508	137	.12687	17	.88741	13	33
28	.46123	26	.16810	121	.51983	37	.92371	136	.12704	17	.88728	13	32
29	.46149	26	.16689	121	.52020	37	.92235	137	.12721	17	.88715	14	31
30	0.46175	26	2.16568	121	0.52057	37	1.92098	136	1.12738	17	0.88701	13	30
31	.46201	25	.16447	121	.52094	37	.91962	136	.12755	17	.88688	14	29
32	.46226	26	.16326	120	.52131	37	.91826	136	.12772	17	.88674	13	28
33	.46252	26	.16206	121	.52168	37	.91690	136	.12789	18	.88661	14	27
34	.46278	26	.16085	120	.52205	37	.91554	136	.12807	17	.88647	13	26
35	0.46304	26	2.15965	120	0.52242	37	1.91418	136	1.12824	17	0.88634	14	25
36	.46330	25	.15845	120	.52279	37	.91282	135	.12841	17	.88620	13	24
37	.46355	26	.15725	120	.52316	37	.91147	135	.12858	17	.88607	14	23
38	.46381	26	.15605	120	.52353	37	.91012	136	.12875	17	.88593	13	22
39	.46407	26	.15485	119	.52390	37	.90876	135	.12892	18	.88580	14	21
40	0.46433	25	2.15366	120	0.52427	37	1.90741	134	1.12910	17	0.88566	13	20
41	.46458	26	.15246	119	.52464	37	.90607	135	.12927	17	.88553	14	19
42	.46484	26	.15127	119	.52501	37	.90472	135	.12944	17	.88539	13	18
43	.46510	26	.15008	119	.52538	37	.90337	134	.12961	18	.88526	14	17
44	.46536	25	.14889	119	.52575	38	.90203	134	.12979	17	.88512	13	16
45	0.46561	26	2.14770	119	0.52613	37	1.90069	134	1.12996	17	0.88499	14	15
46	.46587	26	.14651	118	.52650	37	.89935	134	.13013	18	.88485	13	14
47	.46613	26	.14533	119	.52687	37	.89801	134	.13031	17	.88472	14	13
48	.46639	25	.14414	118	.52724	37	.89667	134	.13048	17	.88458	13	12
49	.46664	26	.14296	118	.52761	37	.89533	133	.13065	18	.88445	14	11
50	0.46690	26	2.14178	118	0.52798	38	1.89400	134	1.13083	17	0.88431	14	10
51	.46716	26	.14060	118	.52836	37	.89266	133	.13100	17	.88417	13	9
52	.46742	25	.13942	117	.52873	37	.89133	133	.13117	18	.88404	14	8
53	.46767	26	.13825	118	.52910	37	.89000	133	.13135	17	.88390	13	7
54	.46793	26	.13707	117	.52947	38	.88867	133	.13152	18	.88377	14	6
55	0.46819	25	2.13590	117	0.52985	37	1.88734	132	1.13170	17	0.88363	14	5
56	.46844	26	.13473	117	.53022	37	.88602	133	.13187	18	.88349	13	4
57	.46870	26	.13356	117	.53059	37	.88469	132	.13205	17	.88336	14	3
58	.46896	25	.13239	117	.53096	38	.88337	132	.13222	17	.88322	14	2
59	.46921	26	.13122	117	.53134	37	.88205	132	.13239	18	.88308	13	1
60	0.46947	2.13005		117	0.53171	37	1.88073	132	1.13257		0.88295		0
↑ 117°	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	↑ 62°

Natural Trigonometric Functions

28° ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	+151° ↓
0	0.46947	26	2.13005	116	0.53171	37	1.88073	132	1.13257	18	0.88295	14	60
1	.46973	26	.12889	116	.53208	38	.87941	132	.13275	17	.88281	14	59
2	.46999	25	.12773	116	.53246	37	.87809	132	.13292	18	.88267	13	58
3	.47024	26	.12657	117	.53283	37	.87677	131	.13310	17	.88254	14	57
4	.47050	26	.12540	115	.53320	38	.87546	131	.13327	18	.88240	14	56
5	0.47076	25	2.12425	116	0.53358	37	1.87415	132	1.13345	17	0.88226	13	55
6	.47101	26	.12309	116	.53395	37	.87283	131	.13362	18	.88213	14	54
7	.47127	26	.12193	115	.53432	38	.87152	131	.13380	18	.88199	14	53
8	.47153	25	.12078	115	.53470	37	.87021	130	.13398	17	.88185	13	52
9	.47178	26	.11963	116	.53507	38	.86891	131	.13415	18	.88172	14	51
10	0.47204	25	2.11847	115	0.53545	37	1.86760	130	1.13433	18	0.88158	14	50
11	.47229	26	.11732	115	.53582	38	.86630	131	.13451	17	.88144	14	49
12	.47255	26	.11617	114	.53620	37	.86499	130	.13468	18	.88130	13	48
13	.47281	25	.11503	115	.53657	37	.86369	130	.13486	18	.88117	14	47
14	.47306	26	.11388	114	.53694	38	.86239	130	.13504	17	.88103	14	46
15	0.47332	26	2.11274	115	0.53732	37	1.86109	130	1.13521	18	0.88089	14	45
16	.47358	25	.11159	114	.53769	38	.85979	129	.13539	18	.88075	13	44
17	.47383	26	.11045	114	.53807	37	.85850	130	.13557	18	.88062	14	43
18	.47409	25	.10931	114	.53844	38	.85720	129	.13575	18	.88048	14	42
19	.47434	26	.10817	113	.53882	38	.85591	129	.13593	17	.88034	14	41
20	0.47460	26	2.10704	114	0.53920	37	1.85462	129	1.13610	18	0.88020	14	40
21	.47486	25	.10590	113	.53957	38	.85333	129	.13628	18	.88006	13	39
22	.47511	26	.10477	114	.53995	37	.85204	129	.13646	18	.87993	14	38
23	.47537	25	.10363	113	.54032	38	.85075	129	.13664	18	.87979	14	37
24	.47562	26	.10250	113	.54070	37	.84946	128	.13682	18	.87965	14	36
25	0.47588	26	2.10137	113	0.54107	38	1.84818	129	1.13700	18	0.87951	14	35
26	.47614	25	.10024	113	.54145	38	.84689	128	.13718	17	.87937	14	34
27	.47639	26	.09911	112	.54183	37	.84561	128	.13735	18	.87923	14	33
28	.47665	25	.09799	113	.54220	38	.84433	128	.13753	18	.87909	13	32
29	.47690	26	.09686	112	.54258	38	.84305	128	.13771	18	.87896	14	31
30	0.47716	25	2.09574	112	0.54296	37	1.84177	128	1.13789	18	0.87882	14	30
31	.47741	26	.09462	112	.54333	38	.84049	127	.13807	18	.87868	14	29
32	.47767	26	.09350	112	.54371	38	.83922	128	.13825	18	.87854	14	28
33	.47793	25	.09238	112	.54409	37	.83794	127	.13843	18	.87840	14	27
34	.47818	26	.09126	112	.54446	38	.83667	127	.13861	18	.87826	14	26
35	0.47844	25	2.09014	111	0.54484	38	1.83540	127	1.13879	18	0.87812	14	25
36	.47869	26	.08903	112	.54522	38	.83413	127	.13897	19	.87798	14	24
37	.47895	25	.08791	111	.54560	37	.83286	127	.13916	18	.87784	14	23
38	.47920	26	.08680	111	.54597	38	.83159	126	.13934	18	.87770	14	22
39	.47946	25	.08569	111	.54635	38	.83033	127	.13952	18	.87756	13	21
40	0.47971	26	2.08458	111	0.54673	38	1.82906	126	1.13970	18	0.87743	14	20
41	.47997	25	.08347	111	.54711	37	.82780	126	.13988	18	.87729	14	19
42	.48022	26	.08236	110	.54748	38	.82654	126	.14006	18	.87715	14	18
43	.48048	25	.08126	111	.54786	38	.82528	126	.14024	18	.87701	14	17
44	.48073	26	.08015	110	.54824	38	.82402	126	.14042	19	.87687	14	16
45	0.48099	25	2.07905	110	0.54862	38	1.82276	126	1.14061	18	0.87673	14	15
46	.48124	26	.07795	110	.54900	38	.82150	125	.14079	18	.87659	14	14
47	.48150	26	.07685	110	.54938	37	.82025	126	.14097	18	.87645	14	13
48	.48175	25	.07575	110	.54975	38	.81899	125	.14115	19	.87631	14	12
49	.48201	25	.07465	109	.55013	38	.81774	125	.14134	18	.87617	14	11
50	0.48226	26	2.07356	110	0.55051	38	1.81649	125	1.14152	18	0.87603	14	10
51	.48252	25	.07246	109	.55089	38	.81524	125	.14170	18	.87589	14	9
52	.48277	26	.07137	110	.55127	38	.81399	125	.14188	19	.87575	14	8
53	.48303	25	.07027	109	.55165	38	.81274	124	.14207	18	.87561	15	7
54	.48328	26	.06918	109	.55203	38	.81150	125	.14225	18	.87546	14	6
55	0.48354	25	2.06809	108	0.55241	38	1.81025	124	1.14243	19	0.87532	14	5
56	.48379	26	.06701	109	.55279	38	.80901	124	.14262	18	.87518	14	4
57	.48405	25	.06592	109	.55317	38	.80777	124	.14280	19	.87504	14	3
58	.48430	26	.06483	108	.55355	38	.80653	124	.14299	18	.87490	14	2
59	.48456	25	.06375	108	.55393	38	.80529	124	.14317	18	.87476	14	1
60	0.48481	25	2.06267	108	0.55431	38	1.80405	124	1.14335	18	0.87462	14	0
↑ 118°	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	↑ 61°

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Natural Trigonometric Functions

29° ↑	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	150° ↑
0	0.48481	25	2.06267	109	0.55431	38	1.80405	124	1.14335	19	0.87462	14	40
1	0.48506	26	0.6158	108	0.55469	38	0.80281	123	1.14354	18	0.87438	14	39
2	0.48532	25	0.6050	108	0.55507	38	0.80158	123	1.14372	19	0.87413	14	38
3	0.48557	26	0.5942	107	0.55545	38	0.80034	123	1.14391	18	0.87389	14	57
4	0.48583	25	0.5835	108	0.55583	38	0.79911	123	1.14409	19	0.87364	14	56
5	0.48608	26	2.05727	108	0.55621	38	1.79788	123	1.14428	18	0.87339	14	55
6	0.48634	25	0.5619	107	0.55659	38	0.79665	123	1.14446	19	0.87314	14	54
7	0.48659	25	0.5512	107	0.55697	39	0.79542	123	1.14465	18	0.87289	14	53
8	0.48684	26	0.5405	107	0.55736	38	0.79410	123	1.14483	19	0.87264	14	52
9	0.48710	25	0.5298	107	0.55774	38	0.79296	122	1.14502	19	0.87239	14	51
10	0.48735	26	2.05191	107	0.55812	38	1.79174	123	1.14521	18	0.87214	14	50
11	0.48761	25	0.5084	107	0.55850	38	0.79051	122	1.14539	19	0.87189	14	49
12	0.48786	25	0.4977	107	0.55888	38	0.78929	122	1.14558	18	0.87164	14	48
13	0.48811	26	0.4870	106	0.55926	38	0.78807	122	1.14576	19	0.87139	14	47
14	0.48837	25	0.4764	107	0.55964	39	0.78685	122	1.14595	19	0.87114	14	46
15	0.48862	26	2.04657	106	0.56003	38	1.78563	122	1.14614	18	0.87250	15	45
16	0.48888	25	0.4451	106	0.56041	38	0.78441	122	1.14632	19	0.87225	14	44
17	0.48913	25	0.4415	106	0.56079	38	0.78319	121	1.14651	19	0.87200	14	43
18	0.48938	25	0.4339	106	0.56117	38	0.78198	121	1.14670	19	0.87175	14	42
19	0.48964	26	0.4233	105	0.56156	39	0.78077	122	1.14689	18	0.87150	14	41
20	0.48989	25	2.04128	106	0.56194	38	1.77955	121	1.14707	19	0.87125	14	40
21	0.49014	26	0.4022	106	0.56232	38	0.77834	121	1.14726	19	0.87100	14	39
22	0.49040	25	0.3916	105	0.56270	39	0.77713	121	1.14745	19	0.87075	14	38
23	0.49065	25	0.3811	105	0.56309	38	0.77592	121	1.14764	18	0.87050	14	37
24	0.49090	26	0.3706	105	0.56347	38	0.77471	120	1.14782	19	0.87025	14	36
25	0.49116	25	2.03601	105	0.56385	38	1.77351	121	1.14801	19	0.87000	14	35
26	0.49141	25	0.3496	105	0.56424	39	0.77230	120	1.14820	19	0.86975	14	34
27	0.49166	26	0.3391	105	0.56462	39	0.77110	120	1.14839	19	0.86950	14	33
28	0.49192	25	0.3286	104	0.56501	38	0.76990	121	1.14858	19	0.86925	14	32
29	0.49217	25	0.3182	105	0.56539	38	0.76869	120	1.14877	19	0.86900	14	31
30	0.49242	26	2.03077	104	0.56577	38	1.76749	120	1.14896	18	0.86875	14	30
31	0.49268	25	0.2973	104	0.56616	39	0.76629	119	1.14914	19	0.86850	14	29
32	0.49293	25	0.2868	104	0.56654	39	0.76510	120	1.14933	19	0.86825	14	28
33	0.49318	25	0.2765	104	0.56693	38	0.76390	119	1.14952	19	0.86800	14	27
34	0.49344	26	0.2661	104	0.56731	38	0.76271	120	1.14971	19	0.86775	14	26
35	0.49369	25	2.02557	104	0.56769	38	1.76151	119	1.14990	19	0.86750	14	25
36	0.49394	25	0.2453	104	0.56808	39	0.76032	119	1.15009	19	0.86725	14	24
37	0.49419	26	0.2346	103	0.56846	39	0.75913	119	1.15028	19	0.86700	14	23
38	0.49445	25	0.2246	103	0.56885	38	0.75794	119	1.15047	19	0.86675	14	22
39	0.49470	25	0.2143	104	0.56923	39	0.75675	119	1.15066	19	0.86650	14	21
40	0.49495	26	2.02039	103	0.56962	38	1.75556	119	1.15085	20	0.86625	14	20
41	0.49521	25	0.1936	103	0.57000	39	0.75437	118	1.15105	19	0.86600	14	19
42	0.49546	25	0.1833	103	0.57039	39	0.75319	119	1.15124	19	0.86575	14	18
43	0.49571	25	0.1730	102	0.57078	38	0.75200	118	1.15143	19	0.86550	14	17
44	0.49596	26	0.1628	103	0.57116	39	0.75082	118	1.15162	19	0.86525	14	16
45	0.49622	25	2.01525	103	0.57155	39	1.74964	118	1.15181	19	0.86500	14	15
46	0.49647	25	0.1422	102	0.57193	38	0.74846	118	1.15200	19	0.86475	14	14
47	0.49672	25	0.1320	102	0.57232	39	0.74728	118	1.15219	20	0.86450	14	13
48	0.49697	26	0.1218	102	0.57271	38	0.74610	118	1.15239	19	0.86425	14	12
49	0.49723	25	0.1116	102	0.57309	39	0.74492	117	1.15258	19	0.86400	14	11
50	0.49748	25	2.01014	102	0.57348	38	1.74375	117	1.15277	19	0.86375	14	10
51	0.49773	25	0.0912	102	0.57386	39	0.74257	118	1.15296	19	0.86350	14	9
52	0.49798	26	0.0810	102	0.57425	39	0.74140	118	1.15315	20	0.86325	14	8
53	0.49824	25	0.0708	101	0.57464	39	0.74022	117	1.15334	19	0.86300	14	7
54	0.49849	25	0.0607	102	0.57503	38	0.73905	117	1.15353	19	0.86275	14	6
55	0.49874	25	2.00505	101	0.57541	39	1.73788	117	1.15373	20	0.86250	14	5
56	0.49899	25	0.0404	101	0.57580	39	0.73671	117	1.15393	19	0.86225	14	4
57	0.49924	26	0.0303	101	0.57619	38	0.73555	116	1.15412	19	0.86200	14	3
58	0.49950	25	0.0202	101	0.57657	39	0.73438	117	1.15431	20	0.86175	14	2
59	0.49975	25	0.0101	101	0.57696	39	0.73321	116	1.15451	19	0.86150	14	1
60	0.50000	25	2.00000	101	0.57735	39	1.73205	116	1.15470	19	0.86125	14	0
119°	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	60°

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Natural Trigonometric Functions

$30^\circ \rightarrow$ \downarrow	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	$\leftarrow 149^\circ$ \downarrow
0	0.50000	25	2.00000	101	0.57735	39	1.73205	116	1.15470	19	0.86603	15	60
1	.50025	25	1.99899	100	.57774	39	.73089	116	.15489	20	.86588	15	59
2	.50050	26	.99799	101	.57813	38	.72973	116	.15509	20	.86573	14	58
3	.50076	25	.99698	100	.57851	39	.72857	116	.15528	20	.86559	15	57
4	.50101	25	.99598	100	.57890	39	.72741	116	.15548	19	.86544	14	56
5	.50126	25	1.99498	100	.57929	39	1.72625	116	1.15567	20	0.86530	15	55
6	.50151	25	.99398	100	.57968	39	.72509	116	.15587	20	.86515	14	54
7	.50176	25	.99298	100	.58007	39	.72393	115	.15606	19	.86501	15	53
8	.50201	25	.99198	100	.58046	39	.72278	115	.15626	20	.86486	15	52
9	.50227	25	.99098	100	.58085	39	.72163	116	.15645	19	.86471	14	51
10	.50252	25	1.98998	99	.58124	38	1.72047	115	1.15665	20	0.86457	15	50
11	.50277	25	.98899	99	.58162	39	.71932	115	.15684	20	.86442	15	49
12	.50302	25	.98799	100	.58201	39	.71817	115	.15704	20	.86427	14	48
13	.50327	25	.98700	99	.58240	39	.71702	114	.15724	19	.86413	14	47
14	.50352	25	.98601	99	.58279	39	.71588	115	.15743	20	.86398	15	46
15	.50377	26	1.98502	99	.58318	39	1.71473	115	1.15763	19	0.86384	15	45
16	.50403	25	.98403	99	.58356	39	.71358	114	.15782	20	.86369	15	44
17	.50428	25	.98304	99	.58396	39	.71244	115	.15802	20	.86354	14	43
18	.50453	25	.98205	99	.58435	39	.71129	114	.15822	19	.86340	14	42
19	.50478	25	.98107	98	.58474	39	.71015	114	.15841	20	.86325	15	41
20	.50503	25	1.98008	98	.58513	39	1.70901	114	1.15861	20	0.86310	15	40
21	.50528	25	.97910	99	.58552	39	.70787	114	.15881	20	.86295	14	39
22	.50553	25	.97811	98	.58591	40	.70673	113	.15901	19	.86281	15	38
23	.50578	25	.97713	98	.58631	39	.70560	114	.15920	20	.86266	15	37
24	.50603	25	.97615	98	.58670	39	.70446	114	.15940	20	.86251	14	36
25	.50628	26	1.97517	97	.58709	39	1.70332	113	1.15960	20	0.86237	15	35
26	.50654	25	.97420	98	.58748	39	.70219	113	.15980	20	.86222	15	34
27	.50679	25	.97322	98	.58787	39	.70106	113	.16000	19	.86207	15	33
28	.50704	25	.97224	97	.58826	39	.69992	113	.16019	20	.86192	14	32
29	.50729	25	.97127	98	.58865	40	.69879	113	.16039	20	.86178	15	31
30	.50754	25	1.97029	97	.58905	39	1.69766	113	1.16059	20	0.86163	15	30
31	.50779	25	.96932	97	.58944	39	.69653	112	.16079	20	.86148	15	29
32	.50804	25	.96835	97	.58983	39	.69541	113	.16099	20	.86133	15	28
33	.50829	25	.96738	97	.59022	39	.69428	112	.16119	20	.86119	14	27
34	.50854	25	.96641	97	.59061	40	.69316	113	.16139	20	.86104	15	26
35	.50879	25	1.96544	96	.59101	39	1.69203	112	1.16159	20	0.86089	15	25
36	.50904	25	.96448	97	.59140	39	.69091	112	.16179	20	.86074	15	24
37	.50929	25	.96351	97	.59179	39	.68979	112	.16199	20	.86059	15	23
38	.50954	25	.96255	96	.59218	40	.68866	113	.16219	20	.86045	14	22
39	.50979	25	.96158	96	.59258	39	.68754	111	.16239	20	.86030	15	21
40	.51004	25	1.96062	96	.59297	39	1.68643	112	1.16259	20	0.86015	15	20
41	.51029	25	.95966	96	.59336	40	.68531	112	.16279	20	.86000	15	19
42	.51054	25	.95870	96	.59376	39	.68419	111	.16299	20	.85985	15	18
43	.51079	25	.95774	96	.59415	39	.68308	111	.16319	20	.85970	15	17
44	.51104	25	.95678	96	.59454	40	.68196	111	.16339	20	.85956	15	16
45	.51129	25	1.95583	95	.59494	39	1.68085	111	1.16359	21	0.85941	15	15
46	.51154	25	.95487	95	.59533	40	.67974	111	.16380	20	.85926	15	14
47	.51179	25	.95392	95	.59573	39	.67863	111	.16400	20	.85911	15	13
48	.51204	25	.95296	95	.59612	39	.67752	111	.16420	20	.85896	15	12
49	.51229	25	.95201	95	.59651	40	.67641	111	.16440	20	.85881	15	11
50	.51254	25	1.95106	95	.59691	39	1.67530	111	1.16460	21	0.85866	15	10
51	.51279	25	.95011	95	.59730	40	.67419	110	.16481	20	.85851	15	9
52	.51304	25	.94916	95	.59770	39	.67309	110	.16501	20	.85836	15	8
53	.51329	25	.94821	95	.59809	40	.67198	110	.16521	20	.85821	15	7
54	.51354	25	.94726	94	.59849	39	.67088	110	.16541	21	.85806	14	6
55	.51379	25	1.94632	95	.59888	40	.66978	111	1.16562	20	0.85792	15	5
56	.51404	25	.94537	94	.59928	39	.66867	110	.16582	20	.85777	15	4
57	.51429	25	.94443	94	.59967	40	.66757	110	.16602	21	.85762	15	3
58	.51454	25	.94349	95	.60007	39	.66647	109	.16623	20	.85747	15	2
59	.51479	25	.94254	95	.60046	40	.66538	110	.16643	20	.85732	15	1
60	.51504	25	1.94160	94	.60086	40	1.66428	110	1.16663	20	0.85717	15	0
$\uparrow 120^\circ$	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	$\leftarrow 59^\circ$ \uparrow

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Natural Trigonometric Functions

31° →		Diff.		Diff.			Diff.		Diff.			Diff.	← 148°
↓	sin	1'	csc	1'	tan	1'	cot	1'	sec	1'	cos	1'	↓
0	0.51504	25	1.94160	94	0.60086	40	1.66428	110	1.16663	21	0.85717	15	60
1	.51529	25	.94066	93	.60126	39	.66318	109	.16684	20	.85702	15	59
2	.51554	25	.93973	94	.60165	40	.66209	110	.16704	21	.85687	15	58
3	.51579	25	.93879	94	.60205	40	.66099	109	.16725	20	.85672	15	57
4	.51604	24	.93785	93	.60245	39	.65990	109	.16745	21	.85657	15	56
5	0.51628	25	1.93692	94	0.60284	40	1.65881	109	1.16766	20	0.85642	15	55
6	.51653	25	.93598	93	.60324	40	.65772	109	.16786	20	.85627	15	54
7	.51678	25	.93505	93	.60364	39	.65663	109	.16806	21	.85612	15	53
8	.51703	25	.93412	93	.60403	40	.65554	109	.16827	21	.85597	15	52
9	.51728	25	.93319	93	.60443	40	.65445	108	.16848	20	.85582	15	51
10	0.51753	25	1.93226	93	0.60483	39	1.65337	109	1.16868	21	0.85567	16	50
11	.51778	25	.93133	93	.60522	40	.65228	108	.16889	20	.85551	15	49
12	.51803	25	.93040	93	.60562	40	.65120	109	.16909	21	.85536	15	48
13	.51828	24	.92947	92	.60602	40	.65011	108	.16930	20	.85521	15	47
14	.51852	25	.92855	93	.60642	39	.64903	108	.16950	21	.85506	15	46
15	0.51877	25	1.92762	92	0.60681	40	1.64795	108	1.16971	21	0.85491	15	45
16	.51902	25	.92670	92	.60721	40	.64687	108	.16992	20	.85476	15	44
17	.51927	25	.92578	92	.60761	40	.64579	108	.17012	21	.85461	15	43
18	.51952	25	.92486	92	.60801	40	.64471	108	.17033	21	.85446	15	42
19	.51977	25	.92394	92	.60841	40	.64363	107	.17054	21	.85431	15	41
20	0.52002	24	1.92302	92	0.60881	40	1.64256	108	1.17075	20	0.85416	15	40
21	.52026	25	.92210	92	.60921	39	.64148	107	.17095	21	.85401	16	39
22	.52051	25	.92118	91	.60960	40	.64041	107	.17116	21	.85385	15	38
23	.52076	25	.92027	92	.61000	40	.63934	108	.17137	21	.85370	15	37
24	.52101	25	.91935	91	.61040	40	.63826	107	.17158	20	.85355	15	36
25	0.52126	25	1.91844	92	0.61080	40	1.63719	107	1.17178	21	0.85340	15	35
26	.52151	24	.91752	91	.61120	40	.63612	107	.17199	21	.85325	15	34
27	.52175	25	.91661	91	.61160	40	.63505	107	.17220	21	.85310	16	33
28	.52200	25	.91570	91	.61200	40	.63398	106	.17241	21	.85294	15	32
29	.52225	25	.91479	91	.61240	40	.63292	107	.17262	21	.85279	15	31
30	0.52250	25	1.91388	91	0.61280	40	1.63185	106	1.17283	21	0.85264	15	30
31	.52275	24	.91297	90	.61320	40	.63079	107	.17304	21	.85249	15	29
32	.52299	25	.91207	91	.61360	40	.62972	106	.17325	21	.85234	16	28
33	.52324	25	.91116	90	.61400	40	.62866	106	.17346	21	.85218	15	27
34	.52349	25	.91026	91	.61440	40	.62760	106	.17367	21	.85203	15	26
35	0.52374	25	1.90935	90	0.61480	40	1.62654	106	1.17388	21	0.85188	15	25
36	.52399	24	.90845	90	.61520	41	.62548	106	.17409	21	.85173	16	24
37	.52423	25	.90755	90	.61561	40	.62442	106	.17430	21	.85157	15	23
38	.52448	25	.90665	90	.61601	40	.62336	106	.17451	21	.85142	15	22
39	.52473	25	.90575	90	.61641	40	.62230	105	.17472	21	.85127	15	21
40	0.52498	24	1.90485	90	0.61681	40	1.62125	106	1.17493	21	0.85112	16	20
41	.52522	25	.90395	90	.61721	40	.62019	105	.17514	21	.85096	15	19
42	.52547	25	.90305	89	.61761	40	.61914	105	.17535	21	.85081	15	18
43	.52572	25	.90216	90	.61801	41	.61809	106	.17556	21	.85066	15	17
44	.52597	24	.90126	89	.61842	40	.61703	105	.17577	21	.85051	16	16
45	0.52621	25	1.90037	89	0.61882	40	1.61598	105	1.17598	22	0.85035	15	15
46	.52646	25	.89948	90	.61922	40	.61493	105	.17620	21	.85020	15	14
47	.52671	25	.89858	89	.61962	41	.61388	105	.17641	21	.85005	16	13
48	.52696	24	.89769	89	.62003	40	.61283	104	.17662	21	.84989	15	12
49	.52720	25	.89680	89	.62043	40	.61179	105	.17683	21	.84974	15	11
50	0.52745	25	1.89591	88	0.62083	41	1.61074	104	1.17704	22	0.84959	16	10
51	.52770	24	.89503	89	.62124	40	.60970	105	.17726	21	.84943	15	9
52	.52794	25	.89414	89	.62164	40	.60865	104	.17747	21	.84928	15	8
53	.52819	25	.89325	88	.62204	41	.60761	104	.17768	22	.84913	16	7
54	.52844	25	.89237	89	.62245	40	.60657	104	.17790	21	.84897	15	6
55	0.52869	24	1.89148	88	0.62285	40	1.60553	104	1.17811	21	0.84882	16	5
56	.52893	25	.89060	88	.62325	41	.60449	104	.17832	22	.84866	15	4
57	.52918	25	.88972	88	.62366	40	.60345	104	.17854	21	.84851	15	3
58	.52943	24	.88884	88	.62406	40	.60241	104	.17875	21	.84836	16	2
59	.52967	25	.88796	88	.62446	41	.60137	104	.17896	22	.84820	15	1
60	0.52992	25	1.88708	88	0.62487	41	1.60033	104	1.17918	22	0.84805	15	0
↑ 121° →	cos	Diff.	sec	Diff.	cot	Diff.	tan	Diff.	csc	Diff.	sin	Diff.	↑ 58°
1'		1'		1'		1'		1'		1'		1'	

Natural Trigonometric Functions

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32°→	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	←147°
0	0.52992	25	1.88708	88	0.62487	40	1.60033	103	1.17918	21	0.84805	16	60
1	.53017	24	.88620	88	.62527	41	.59930	104	.17939	22	.84789	15	59
2	.53041	25	.88532	87	.62568	40	.59826	103	.17961	21	.84774	15	58
3	.53066	25	.88445	88	.62608	41	.59723	103	.17982	22	.84759	16	57
4	.53091	24	.88357	87	.62649	40	.59620	103	.18004	21	.84743	15	56
5	0.53115	25	1.88270	87	0.62689	41	1.59517	103	1.18025	22	0.84728	16	55
6	.53140	24	.88183	88	.62730	40	.59414	103	.18047	21	.84712	15	54
7	.53164	25	.88095	87	.62770	41	.59311	103	.18068	22	.84697	16	53
8	.53189	25	.88008	87	.62811	41	.59208	103	.18090	21	.84681	15	52
9	.53214	24	.87921	87	.62852	40	.59105	103	.18111	22	.84666	16	51
10	0.53238	25	1.87834	86	0.62892	41	1.59002	102	1.18133	22	0.84650	15	50
11	.53263	25	.87748	87	.62933	40	.58900	103	.18155	21	.84635	16	49
12	.53288	24	.87661	87	.62973	41	.58797	102	.18176	22	.84619	15	48
13	.53312	25	.87574	86	.63014	41	.58695	102	.18198	22	.84604	16	47
14	.53337	24	.87488	87	.63055	40	.58593	103	.18220	21	.84588	15	46
15	0.53361	25	1.87401	86	0.63095	41	1.58490	102	1.18241	22	0.84573	16	45
16	.53386	25	.87315	86	.63136	41	.58388	102	.18263	22	.84557	15	44
17	.53411	24	.87229	87	.63177	40	.58286	102	.18285	22	.84542	16	43
18	.53435	25	.87142	86	.63217	41	.58184	101	.18307	21	.84526	15	42
19	.53460	24	.87056	86	.63258	41	.58083	102	.18328	22	.84511	16	41
20	0.53484	25	1.86970	85	0.63299	41	1.57981	102	1.18350	22	0.84495	15	40
21	.53509	25	.86885	86	.63340	40	.57879	101	.18372	22	.84480	16	39
22	.53534	24	.86799	86	.63380	41	.57778	102	.18394	22	.84464	16	38
23	.53558	25	.86713	86	.63421	41	.57676	101	.18416	21	.84448	15	37
24	.53583	24	.86627	85	.63462	41	.57575	101	.18437	22	.84433	16	36
25	0.53607	25	1.86542	85	0.63503	41	1.57474	102	1.18459	22	0.84417	15	35
26	.53632	24	.86457	86	.63544	40	.57372	101	.18481	22	.84402	16	34
27	.53656	25	.86371	85	.63584	41	.57271	101	.18503	22	.84386	16	33
28	.53681	24	.86286	85	.63625	41	.57170	101	.18525	22	.84370	15	32
29	.53705	25	.86201	85	.63666	41	.57069	100	.18547	22	.84355	16	31
30	0.53730	24	1.86116	85	0.63707	41	1.56969	101	1.18569	22	0.84339	15	30
31	.53754	25	.86031	85	.63748	41	.56868	101	.18591	22	.84324	16	29
32	.53779	25	.85946	85	.63789	41	.56767	100	.18613	22	.84308	16	28
33	.53804	24	.85861	84	.63830	41	.56667	101	.18635	22	.84292	15	27
34	.53828	25	.85777	85	.63871	41	.56566	100	.18657	22	.84277	16	26
35	0.53853	24	1.85692	84	0.63912	41	1.56466	100	1.18679	22	0.84261	16	25
36	.53877	25	.85608	85	.63953	41	.56366	101	.18701	22	.84245	15	24
37	.53902	24	.85523	84	.63994	41	.56265	100	.18723	22	.84230	16	23
38	.53926	25	.85439	84	.64035	41	.56165	100	.18745	22	.84214	16	22
39	.53951	24	.85355	84	.64076	41	.56065	99	.18767	23	.84198	16	21
40	0.53975	25	1.85271	84	0.64117	41	1.55966	100	1.18790	22	0.84182	15	20
41	.54000	24	.85187	84	.64158	41	.55866	100	.18812	22	.84167	16	19
42	.54024	25	.85103	84	.64199	41	.55766	100	.18834	22	.84151	16	18
43	.54049	24	.85019	84	.64240	41	.55666	99	.18856	22	.84135	15	17
44	.54073	24	.84935	83	.64281	41	.55567	100	.18878	23	.84120	16	16
45	0.54097	25	1.84852	84	0.64322	41	1.55467	99	1.18901	22	0.84104	16	15
46	.54122	24	.84768	83	.64363	41	.55368	99	.18923	22	.84088	16	14
47	.54146	25	.84685	84	.64404	42	.55269	99	.18945	22	.84072	15	13
48	.54171	24	.84601	83	.64446	41	.55170	99	.18967	23	.84057	16	12
49	.54195	25	.84518	83	.64487	41	.55071	99	.18990	22	.84041	16	11
50	0.54220	24	1.84435	83	0.64528	41	1.54972	99	1.19012	22	0.84025	16	10
51	.54244	25	.84352	83	.64569	41	.54873	99	.19034	23	.84009	15	9
52	.54269	24	.84269	83	.64610	42	.54774	99	.19057	22	.83994	16	8
53	.54293	24	.84186	83	.64652	41	.54675	99	.19079	23	.83978	16	7
54	.54317	25	.84103	83	.64693	41	.54576	98	.19102	22	.83962	16	6
55	0.54342	24	1.84020	82	0.64734	41	1.54478	99	1.19124	22	0.83946	16	5
56	.54366	25	.83938	83	.64775	42	.54379	98	.19146	23	.83930	15	4
57	.54391	24	.83855	82	.64817	41	.54281	98	.19169	22	.83915	16	3
58	.54415	25	.83773	83	.64858	41	.54183	98	.19191	23	.83899	16	2
59	.54440	24	.83690	82	.64899	42	.54085	99	.19214	22	.83883	16	1
60	0.54464	24	1.83608	82	0.64941	42	1.53986	99	1.19236	22	0.83867	16	0
↑122°→	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	↑57°

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Natural Trigonometric Functions

33°→		sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	←146°
↓														↓
0	0.54464	24	1.83608	82	0.64941	41	1.53986	98	1.19236	23	0.83867	16	60	
1	.54488	25	.83526	82	.64982	42	.53888	97	.19259	22	.83851	16	59	
2	.54513	24	.83444	82	.65024	41	.53791	98	.19281	23	.83835	16	58	
3	.54537	24	.83362	82	.65065	41	.53693	98	.19304	23	.83819	16	57	
4	.54561	25	.83280	82	.65106	42	.53595	98	.19327	22	.83804	16	56	
5	0.54586	24	1.83198	82	0.65148	41	1.53497	97	1.19349	23	0.83788	16	55	
6	.54610	25	.83116	82	.65189	42	.53400	98	.19372	22	.83772	16	54	
7	.54635	24	.83034	81	.65231	41	.53302	97	.19394	23	.83756	16	53	
8	.54659	24	.82953	82	.65272	42	.53205	98	.19417	23	.83740	16	52	
9	.54683	25	.82871	81	.65314	41	.53107	97	.19440	23	.83724	16	51	
10	0.54708	24	1.82790	81	0.65355	42	1.53010	97	1.19463	22	0.83708	16	50	
11	.54732	24	.82709	82	.65397	41	.52913	97	.19485	23	.83692	16	49	
12	.54756	25	.82627	81	.65438	42	.52816	97	.19508	23	.83676	16	48	
13	.54781	24	.82546	81	.65480	41	.52719	97	.19531	22	.83660	16	47	
14	.54805	24	.82465	81	.65521	42	.52622	97	.19553	23	.83645	16	46	
15	0.54829	25	1.82384	81	0.65563	41	1.52525	96	1.19576	23	0.83629	16	45	
16	.54854	24	.82303	81	.65604	42	.52429	97	.19599	23	.83613	16	44	
17	.54878	24	.82222	80	.65646	42	.52332	97	.19622	23	.83597	16	43	
18	.54902	25	.82142	81	.65688	41	.52235	96	.19645	23	.83581	16	42	
19	.54927	24	.82061	80	.65729	42	.52139	96	.19668	23	.83565	16	41	
20	0.54951	24	1.81981	81	0.65771	42	1.52043	97	1.19691	22	0.83549	16	40	
21	.54975	24	.81900	80	.65813	41	.51946	96	.19713	23	.83533	16	39	
22	.54999	25	.81820	80	.65854	42	.51850	96	.19736	23	.83517	16	38	
23	.55024	24	.81740	81	.65896	42	.51754	96	.19759	23	.83501	16	37	
24	.55048	24	.81659	80	.65938	42	.51658	96	.19782	23	.83485	16	36	
25	0.55072	25	1.81579	80	0.65980	41	1.51562	96	1.19805	23	0.83469	16	35	
26	.55097	24	.81499	80	.66021	42	.51466	96	.19828	23	.83453	16	34	
27	.55121	24	.81419	79	.66063	42	.51370	96	.19851	23	.83437	16	33	
28	.55145	24	.81340	80	.66105	42	.51275	96	.19874	23	.83421	16	32	
29	.55169	25	.81260	80	.66147	42	.51179	95	.19897	23	.83405	16	31	
30	0.55194	24	1.81180	79	0.66189	41	1.51084	96	1.19920	24	0.83389	16	30	
31	.55218	24	.81101	80	.66230	42	.50988	95	.19944	23	.83373	17	29	
32	.55242	24	.81021	79	.66272	42	.50893	96	.19967	23	.83356	16	28	
33	.55266	25	.80942	80	.66314	42	.50797	95	.19990	23	.83340	16	27	
34	.55291	24	.80862	79	.66356	42	.50702	95	.20013	23	.83324	16	26	
35	0.55315	24	1.80783	79	0.66398	42	1.50607	95	1.20036	23	0.83308	16	25	
36	.55339	24	.80704	79	.66440	42	.50512	95	.20059	24	.83292	16	24	
37	.55363	24	.80625	79	.66482	42	.50417	95	.20083	23	.83276	16	23	
38	.55388	25	.80546	79	.66524	42	.50322	94	.20106	23	.83260	16	22	
39	.55412	24	.80467	79	.66566	42	.50228	95	.20129	23	.83244	16	21	
40	0.55436	24	1.80388	79	0.66608	42	1.50133	95	1.20152	24	0.83228	16	20	
41	.55460	24	.80309	78	.66650	42	.50038	94	.20176	23	.83212	17	19	
42	.55484	25	.80231	79	.66692	42	.49944	95	.20199	23	.83195	16	18	
43	.55509	24	.80152	78	.66734	42	.49849	94	.20222	24	.83179	16	17	
44	.55533	24	.80074	79	.66776	42	.49755	94	.20246	23	.83163	16	16	
45	0.55557	24	1.79995	78	0.66818	42	1.49661	95	1.20269	23	0.83147	16	15	
46	.55581	24	.79917	78	.66860	42	.49566	94	.20292	24	.83131	16	14	
47	.55605	25	.79839	78	.66902	42	.49472	94	.20316	23	.83115	17	13	
48	.55630	24	.79761	79	.66944	42	.49378	94	.20339	24	.83098	16	12	
49	.55654	24	.79682	78	.66986	42	.49284	94	.20363	23	.83082	16	11	
50	0.55678	24	1.79604	77	0.67028	43	1.49190	93	1.20386	24	0.83066	16	10	
51	.55702	24	.79527	78	.67071	42	.49097	94	.20410	23	.83050	16	9	
52	.55726	24	.79449	78	.67113	42	.49003	94	.20433	24	.83034	17	8	
53	.55750	25	.79371	78	.67155	42	.48909	93	.20457	23	.83017	16	7	
54	.55775	24	.79293	77	.67197	42	.48816	94	.20480	24	.83001	16	6	
55	0.55799	24	1.79216	78	0.67239	43	1.48722	93	1.20504	23	0.82985	16	5	
56	.55823	24	.79138	77	.67282	42	.48629	93	.20527	24	.82969	16	4	
57	.55847	24	.79061	77	.67324	42	.48536	94	.20551	24	.82953	17	3	
58	.55871	24	.78984	78	.67366	43	.48442	93	.20575	23	.82936	16	2	
59	.55895	24	.78906	77	.67409	42	.48349	93	.20598	24	.82920	16	1	
60	0.55919	24	1.78829	77	0.67451	42	1.48256	93	1.20622	24	0.82904	16	0	
↑123°→	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	←56°	

Natural Trigonometric Functions

(36)

34° ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	←145° ↑
0	0.55919	24	1.78829	77	0.67451	42	1.48256	93	1.20622	23	0.82904	17	60
1	.55943	25	.78752	77	.67493	42	.48163	93	.20645	24	.82887	16	59
2	.55968	24	.78675	77	.67536	43	.48070	93	.20669	24	.82871	16	58
3	.55992	24	.78598	77	.67578	42	.47977	92	.20693	24	.82855	16	57
4	.56016	24	.78521	76	.67620	43	.47885	93	.20717	23	.82839	17	56
5	0.56040	24	1.78445	77	0.67663	42	1.47792	93	1.20740	24	0.82822	16	55
6	.56064	24	.78368	77	.67705	43	.47699	92	.20764	24	.82806	16	54
7	.56088	24	.78291	76	.67748	42	.47607	93	.20788	24	.82790	17	53
8	.56112	24	.78215	77	.67790	42	.47514	92	.20812	24	.82773	16	52
9	.56136	24	.78138	76	.67832	43	.47422	92	.20836	23	.82757	16	51
10	0.56160	24	1.78062	76	0.67875	42	1.47330	92	1.20859	24	0.82741	17	50
11	.56184	24	.77986	76	.67917	43	.47238	92	.20883	24	.82724	16	49
12	.56208	24	.77910	77	.67960	42	.47146	93	.20907	24	.82708	16	48
13	.56232	24	.77833	76	.68002	43	.47053	91	.20931	24	.82692	17	47
14	.56256	24	.77757	76	.68045	43	.46962	92	.20955	24	.82675	16	46
15	0.56280	25	1.77681	75	0.68088	42	1.46870	92	1.20979	24	0.82659	16	45
16	.56305	24	.77606	76	.68130	43	.46778	92	.21003	24	.82643	17	44
17	.56329	24	.77530	76	.68173	42	.46686	91	.21027	24	.82626	16	43
18	.56353	24	.77454	76	.68215	43	.46595	92	.21051	24	.82610	17	42
19	.56377	24	.77378	75	.68258	43	.46503	92	.21075	24	.82593	16	41
20	0.56401	24	1.77303	76	0.68301	42	1.46411	91	1.21099	24	0.82577	16	40
21	.56425	24	.77227	75	.68343	43	.46320	91	.21123	24	.82561	17	39
22	.56449	24	.77152	75	.68386	43	.46229	92	.21147	24	.82544	16	38
23	.56473	24	.77077	76	.68429	42	.46137	91	.21171	24	.82528	17	37
24	.56497	24	.77001	75	.68471	43	.46046	91	.21195	25	.82511	16	36
25	0.56521	24	1.76926	75	0.68514	43	1.45955	91	1.21220	24	0.82495	17	35
26	.56545	24	.76851	75	.68557	43	.45864	91	.21244	24	.82478	16	34
27	.56569	24	.76776	75	.68600	42	.45773	91	.21268	24	.82462	16	33
28	.56593	24	.76701	75	.68642	43	.45682	90	.21292	24	.82446	17	32
29	.56617	24	.76626	74	.68685	43	.45592	91	.21316	25	.82429	16	31
30	0.56641	24	1.76552	75	0.68728	43	1.45501	91	1.21341	24	0.82413	17	30
31	.56665	24	.76477	75	.68771	43	.45410	90	.21365	24	.82396	16	29
32	.56689	24	.76402	74	.68814	43	.45320	91	.21389	25	.82380	17	28
33	.56713	23	.76328	75	.68857	43	.45229	90	.21414	24	.82363	16	27
34	.56736	24	.76253	74	.68900	42	.45139	90	.21438	24	.82347	17	26
35	0.56760	24	1.76179	74	0.68942	43	1.45049	91	1.21462	25	0.82330	16	25
36	.56784	24	.76105	74	.68985	43	.44958	90	.21487	24	.82314	17	24
37	.56808	24	.76031	75	.69028	43	.44868	90	.21511	24	.82297	16	23
38	.56832	24	.75956	74	.69071	43	.44778	90	.21535	25	.82281	17	22
39	.56856	24	.75882	74	.69114	43	.44688	90	.21560	24	.82264	16	21
40	0.56880	24	1.75808	74	0.69157	43	1.44598	90	1.21584	25	0.82248	17	20
41	.56904	24	.75734	73	.69200	43	.44508	90	.21609	24	.82231	17	19
42	.56928	24	.75661	74	.69243	43	.44418	89	.21633	25	.82214	16	18
43	.56952	24	.75587	74	.69286	43	.44329	90	.21658	24	.82198	17	17
44	.56976	24	.75513	73	.69329	43	.44239	90	.21682	25	.82181	16	16
45	0.57000	24	1.75440	74	0.69372	44	1.44149	89	1.21707	24	0.82165	17	15
46	.57024	23	.75366	73	.69416	43	.44060	90	.21731	25	.82148	16	14
47	.57047	24	.75293	74	.69459	43	.43970	89	.21756	25	.82132	17	13
48	.57071	24	.75219	73	.69502	43	.43881	89	.21781	24	.82115	17	12
49	.57095	24	.75146	73	.69545	43	.43792	89	.21805	25	.82098	16	11
50	0.57119	24	1.75073	73	0.69588	43	1.43703	89	1.21830	25	0.82082	17	10
51	.57143	24	.75000	73	.69631	44	.43614	89	.21855	24	.82065	17	9
52	.57167	24	.74927	73	.69675	43	.43525	89	.21879	25	.82048	16	8
53	.57191	24	.74854	73	.69718	43	.43436	89	.21904	25	.82032	17	7
54	.57215	23	.74781	73	.69761	43	.43347	89	.21929	24	.82015	16	6
55	0.57238	24	1.74708	73	0.69804	43	1.43258	89	1.21953	25	0.81999	17	5
56	.57262	24	.74635	73	.69847	44	.43169	89	.21978	25	.81982	17	4
57	.57286	24	.74562	72	.69891	43	.43080	88	.22003	25	.81965	16	3
58	.57310	24	.74490	73	.69934	43	.42992	89	.22028	25	.81949	17	2
59	.57334	24	.74417	72	.69977	44	.42903	88	.22053	24	.81932	17	1
60	0.57358	24	1.74345		0.70021		1.42815		1.22077		0.81915		0
↑124°	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	↑55°

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Natural Trigonometric Functions

35° ↓		sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	←144° ↓
0	0.57358	23	1.74345	73	0.70021	43	1.42815	89	1.22077	25	0.81915	16	60	
1	.57381	24	.74272	72	.70064	43	.42726	88	.22102	25	.81899	17	59	
2	.57405	24	.74200	72	.70107	44	.42638	88	.22127	25	.81882	17	58	
3	.57429	24	.74128	72	.70151	44	.42550	88	.22152	25	.81865	17	57	
4	.57453	24	.74056	73	.70194	43	.42462	88	.22177	25	.81848	16	56	
5	0.57477	24	1.73983	72	0.70238	43	1.42374	88	1.22202	25	0.81832	17	55	
6	.57501	23	.73911	71	.70281	44	.42286	88	.22227	25	.81815	17	54	
7	.57524	24	.73840	72	.70325	43	.42198	88	.22252	25	.81798	16	53	
8	.57548	24	.73768	72	.70368	44	.42110	88	.22277	25	.81782	17	52	
9	.57572	24	.73696	72	.70412	43	.42022	88	.22302	25	.81765	17	51	
10	0.57596	23	1.73624	72	0.70455	44	1.41934	87	1.22327	25	0.81748	17	50	
11	.57619	24	.73552	71	.70499	43	.41847	88	.22352	25	.81731	17	49	
12	.57643	24	.73481	72	.70542	44	.41759	87	.22377	25	.81714	16	48	
13	.57667	24	.73409	71	.70586	43	.41672	88	.22402	26	.81698	17	47	
14	.57691	24	.73338	71	.70629	44	.41584	87	.22428	25	.81681	17	46	
15	0.57715	23	1.73267	72	0.70673	44	1.41497	88	1.22453	25	0.81664	17	45	
16	.57738	24	.73195	71	.70717	43	.41409	87	.22478	25	.81647	16	44	
17	.57762	24	.73124	71	.70760	44	.41322	87	.22503	25	.81631	17	43	
18	.57786	24	.73053	71	.70804	44	.41235	87	.22528	26	.81614	17	42	
19	.57810	23	.72982	71	.70848	43	.41148	87	.22554	25	.81597	17	41	
20	0.57833	24	1.72911	71	0.70891	44	1.41061	87	1.22579	25	0.81580	17	40	
21	.57857	24	.72840	71	.70935	44	.40974	87	.22604	25	.81563	17	39	
22	.57881	23	.72769	71	.70979	44	.40887	87	.22629	26	.81546	16	38	
23	.57904	24	.72698	70	.71023	43	.40800	86	.22655	25	.81530	17	37	
24	.57928	24	.72628	71	.71065	44	.40714	87	.22680	26	.81513	17	36	
25	0.57952	24	1.72557	70	0.71110	44	1.40627	87	1.22706	25	0.81496	17	35	
26	.57976	23	.72487	71	.71154	44	.40540	86	.22731	25	.81479	17	34	
27	.57999	24	.72416	70	.71198	44	.40454	87	.22756	26	.81462	17	33	
28	.58023	24	.72346	71	.71242	43	.40367	86	.22782	25	.81445	17	32	
29	.58047	23	.72275	70	.71285	44	.40281	86	.22807	26	.81428	16	31	
30	0.58070	24	1.72205	70	0.71329	44	1.40195	86	1.22833	25	0.81412	17	30	
31	.58094	24	.72135	70	.71373	44	.40109	87	.22858	26	.81395	17	29	
32	.58118	23	.72065	70	.71417	44	.40022	86	.22884	25	.81378	17	28	
33	.58141	24	.71995	70	.71461	44	.39936	86	.22909	26	.81361	17	27	
34	.58165	24	.71925	70	.71505	44	.39850	86	.22935	25	.81344	17	26	
35	0.58189	23	1.71855	70	0.71549	44	1.39764	85	1.22960	26	0.81327	17	25	
36	.58212	24	.71785	70	.71593	44	.39679	86	.22986	26	.81310	17	24	
37	.58236	24	.71715	69	.71637	44	.39593	86	.23012	25	.81293	17	23	
38	.58260	23	.71646	70	.71681	44	.39507	86	.23037	26	.81276	17	22	
39	.58283	24	.71576	70	.71725	44	.39421	85	.23063	26	.81259	17	21	
40	0.58307	23	1.71506	69	0.71769	44	1.39336	86	1.23089	25	0.81242	17	20	
41	.58330	24	.71437	69	.71813	44	.39250	85	.23114	26	.81225	17	19	
42	.58354	24	.71368	70	.71857	44	.39165	86	.23140	26	.81208	17	18	
43	.58378	23	.71298	69	.71901	44	.39079	85	.23166	26	.81191	17	17	
44	.58401	24	.71229	69	.71946	44	.38994	85	.23192	25	.81174	17	16	
45	0.58425	24	1.71160	69	0.71990	44	1.38909	85	1.23217	26	0.81157	17	15	
46	.58449	23	.71091	69	.72034	44	.38824	86	.23243	26	.81140	17	14	
47	.58472	24	.71022	69	.72078	44	.38738	85	.23269	26	.81123	17	13	
48	.58496	23	.70953	69	.72122	44	.38653	85	.23295	26	.81106	17	12	
49	.58519	24	.70884	69	.72167	44	.38568	84	.23321	26	.81089	17	11	
50	0.58543	24	1.70815	69	0.72211	44	1.38484	85	1.23347	26	0.81072	17	10	
51	.58567	23	.70746	69	.72255	44	.38399	85	.23373	25	.81055	17	9	
52	.58590	24	.70677	68	.72299	45	.38314	85	.23398	26	.81038	17	8	
53	.58614	23	.70609	69	.72344	44	.38229	84	.23424	26	.81021	17	7	
54	.58637	24	.70540	68	.72388	44	.38145	85	.23450	26	.81004	17	6	
55	0.58661	23	1.70472	69	0.72432	45	1.38060	84	1.23476	26	0.80987	17	5	
56	.58684	24	.70403	68	.72477	44	.37976	85	.23502	27	.80970	17	4	
57	.58708	23	.70335	68	.72521	44	.37891	84	.23529	26	.80953	17	3	
58	.58731	24	.70267	69	.72565	45	.37807	85	.23555	26	.80936	17	2	
59	.58755	24	.70198	68	.72610	44	.37722	84	.23581	26	.80919	17	1	
60	0.58779	1	1.70130		0.72654		1.37638		1.23607		0.80902		0	
↑125° cos		Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	↑54°	

Natural Trigonometric Functions

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36° →	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	← 143°
0	0.58779	23	1.70130	68	0.72654	45	1.37638	84	1.23607	26	0.80902	17	60
1	.58802	24	.70062	68	.72699	44	.37554	84	.23633	26	.80885	18	59
2	.58826	23	.69994	68	.72743	45	.37470	84	.23659	26	.80867	17	58
3	.58849	24	.69926	68	.72788	44	.37386	84	.23685	26	.80850	17	57
4	.58873	23	.69858	68	.72832	45	.37302	84	.23711	27	.80833	17	56
5	0.58896	24	1.69790	67	0.72877	44	1.37218	84	1.23738	26	0.80816	17	55
6	.58920	23	.69723	68	.72921	45	.37134	84	.23764	26	.80799	17	54
7	.58943	24	.69655	68	.72966	44	.37050	83	.23790	26	.80782	17	53
8	.58967	23	.69587	67	.73010	45	.36967	84	.23816	27	.80765	17	52
9	.58990	24	.69520	63	.73055	45	.36883	83	.23843	26	.80748	18	51
10	0.59014	23	1.69452	67	0.73100	44	1.36800	84	1.23869	26	0.80730	17	50
11	.59037	24	.69385	67	.73144	45	.36716	83	.23895	27	.80713	17	49
12	.59061	23	.69318	68	.73189	45	.36633	84	.23922	26	.80696	17	48
13	.59084	24	.69250	67	.73234	44	.36549	83	.23948	27	.80679	17	47
14	.59108	23	.69183	67	.73278	45	.36466	83	.23975	26	.80662	18	46
15	0.59131	23	1.69116	67	0.73323	45	1.36383	83	1.24001	27	0.80644	17	45
16	.59154	24	.69049	67	.73368	45	.36300	83	.24028	26	.80627	17	44
17	.59178	23	.68982	67	.73413	44	.36217	83	.24054	27	.80610	17	43
18	.59201	24	.68915	67	.73457	45	.36134	83	.24081	26	.80593	17	42
19	.59225	23	.68848	66	.73502	45	.36051	83	.24107	27	.80576	18	41
20	0.59248	24	1.68782	67	0.73547	45	1.35968	83	1.24134	26	0.80558	17	40
21	.59272	23	.68715	67	.73592	45	.35885	83	.24160	27	.80541	17	39
22	.59295	23	.68648	66	.73637	44	.35802	83	.24187	26	.80524	17	38
23	.59318	24	.68582	67	.73681	45	.35719	82	.24213	27	.80507	18	37
24	.59342	23	.68515	66	.73726	45	.35637	83	.24240	27	.80489	17	36
25	0.59365	24	1.68449	67	0.73771	45	1.35554	82	1.24267	26	0.80472	17	35
26	.59389	23	.68382	66	.73816	45	.35472	83	.24293	27	.80455	17	34
27	.59412	24	.68316	66	.73861	45	.35389	82	.24320	27	.80438	18	33
28	.59436	23	.68250	67	.73906	45	.35307	83	.24347	26	.80420	17	32
29	.59459	23	.68183	66	.73951	45	.35224	82	.24373	27	.80403	17	31
30	0.59482	24	1.68117	66	0.73996	45	1.35142	82	1.24400	27	0.80386	18	30
31	.59506	23	.68051	66	.74041	45	.35060	82	.24427	27	.80368	17	29
32	.59529	23	.67985	66	.74086	45	.34978	82	.24454	27	.80351	17	28
33	.59552	24	.67919	66	.74131	45	.34896	82	.24481	27	.80334	18	27
34	.59576	23	.67853	65	.74176	45	.34814	82	.24508	26	.80316	17	26
35	0.59599	23	1.67788	66	0.74221	46	1.34732	82	1.24534	27	0.80299	17	25
36	.59622	24	.67722	66	.74267	45	.34650	82	.24561	27	.80282	18	24
37	.59646	23	.67656	65	.74312	45	.34568	81	.24588	27	.80264	17	23
38	.59669	24	.67591	66	.74357	45	.34487	82	.24615	27	.80247	17	22
39	.59693	23	.67525	65	.74402	45	.34405	82	.24642	27	.80230	18	21
40	0.59716	23	1.67460	66	0.74447	45	1.34323	81	1.24669	27	0.80212	17	20
41	.59739	24	.67394	65	.74492	46	.34242	82	.24696	27	.80195	17	19
42	.59763	23	.67329	65	.74538	45	.34160	81	.24723	27	.80178	18	18
43	.59786	23	.67264	66	.74583	45	.34079	81	.24750	27	.80160	17	17
44	.59809	23	.67198	65	.74628	46	.33998	82	.24777	27	.80143	18	16
45	0.59832	24	1.67133	65	0.74674	45	1.33916	81	1.24804	28	0.80125	17	15
46	.59856	23	.67068	65	.74719	45	.33835	81	.24832	27	.80108	17	14
47	.59879	23	.67003	65	.74764	46	.33754	81	.24859	27	.80091	18	13
48	.59902	24	.66938	65	.74810	45	.33673	81	.24886	27	.80073	17	12
49	.59926	23	.66873	64	.74855	45	.33592	81	.24913	27	.80056	18	11
50	0.59949	23	1.66809	65	0.74900	46	1.33511	81	1.24940	27	0.80038	17	10
51	.59972	23	.66744	65	.74946	45	.33430	81	.24967	28	.80021	18	9
52	.59995	24	.66679	64	.74991	46	.33349	81	.24995	27	.80003	17	8
53	.60019	23	.66615	65	.75037	45	.33268	81	.25022	27	.79986	18	7
54	.60042	23	.66550	64	.75082	46	.33187	80	.25049	28	.79968	17	6
55	0.60065	24	1.66486	65	0.75128	45	1.33107	81	1.25077	27	0.79951	17	5
56	.60089	23	.66421	64	.75173	46	.33026	80	.25104	27	.79934	18	4
57	.60112	23	.66357	65	.75219	45	.32946	81	.25131	28	.79916	17	3
58	.60135	23	.66292	64	.75264	46	.32865	80	.25159	27	.79899	18	2
59	.60158	24	.66228	64	.75310	45	.32785	81	.25186	28	.79881	17	1
60	0.60182	23	1.66164	64	0.75355	45	1.32704	81	1.25214	28	0.79864	17	0
↑ 126° →	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	↑ 53°

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Natural Trigonometric Functions

37°→													←142°	
↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	↓	
0	.60182	23	1.66164	64	0.75355	46	1.32704	80	1.25214	27	0.79864	18	60	
1	.60205	23	.66100	64	.75401	46	.32624	80	.25241	28	.79846	17	59	
2	.60228	23	.66036	64	.75447	45	.32544	80	.25269	27	.79829	18	58	
3	.60251	23	.65972	64	.75492	46	.32464	80	.25296	28	.79811	18	57	
4	.60274	24	.65908	64	.75538	46	.32384	80	.25324	27	.79793	17	56	
5	.60298	23	1.65844	64	0.75584	45	1.32304	80	1.25351	28	0.79776	18	55	
6	.60321	23	.65780	63	.75629	46	.32224	80	.25379	27	.79758	17	54	
7	.60344	23	.65717	64	.75675	46	.32144	80	.25406	28	.79741	18	53	
8	.60367	23	.65653	64	.75721	46	.32064	80	.25434	28	.79723	18	52	
9	.60390	24	.65589	63	.75767	45	.31984	80	.25462	27	.79706	17	51	
10	.60414	23	1.65526	64	0.75812	46	1.31904	79	1.25489	28	0.79688	17	50	
11	.60437	23	.65462	63	.75858	46	.31825	80	.25517	28	.79671	18	49	
12	.60460	23	.65399	64	.75904	46	.31745	79	.25545	27	.79653	18	48	
13	.60483	23	.65335	63	.75950	46	.31666	80	.25572	28	.79635	17	47	
14	.60506	23	.65272	63	.75996	46	.31586	79	.25600	28	.79618	18	46	
15	.60529	24	1.65209	63	0.76042	46	1.31507	80	1.25628	28	0.79600	17	45	
16	.60553	23	.65146	63	.76088	46	.31427	79	.25656	27	.79583	18	44	
17	.60576	23	.65083	63	.76134	46	.31348	79	.25683	28	.79565	18	43	
18	.60599	23	.65020	63	.76180	46	.31269	79	.25711	28	.79547	17	42	
19	.60622	23	.64957	63	.76226	46	.31190	80	.25739	28	.79530	18	41	
20	.60645	23	1.64894	63	0.76272	46	1.31110	79	1.25767	28	0.79512	18	40	
21	.60668	23	.64831	63	.76318	46	.31031	79	.25795	28	.79494	17	39	
22	.60691	23	.64768	63	.76364	46	.30952	79	.25823	28	.79477	18	38	
23	.60714	24	.64705	62	.76410	46	.30873	78	.25851	28	.79459	18	37	
24	.60738	23	.64643	63	.76456	46	.30795	79	.25879	28	.79441	17	36	
25	.60761	23	1.64580	62	0.76502	46	1.30716	79	1.25907	28	0.79424	18	35	
26	.60784	23	.64518	63	.76548	46	.30637	79	.25935	28	.79406	18	34	
27	.60807	23	.64455	62	.76594	46	.30558	78	.25963	28	.79388	17	33	
28	.60830	23	.64393	63	.76640	46	.30480	79	.25991	28	.79371	18	32	
29	.60853	23	.64330	62	.76686	47	.30401	78	.26019	28	.79353	18	31	
30	.60876	23	1.64268	62	0.76733	46	1.30323	79	1.26047	28	0.79335	17	30	
31	.60899	23	.64206	62	.76779	46	.30244	78	.26075	29	.79318	18	29	
32	.60922	23	.64144	63	.76825	46	.30166	79	.26104	28	.79300	18	28	
33	.60945	23	.64081	62	.76871	47	.30087	78	.26132	28	.79282	18	27	
34	.60968	23	.64019	62	.76918	46	.30009	78	.26160	28	.79264	17	26	
35	.60991	24	1.63957	62	0.76964	46	1.29931	78	1.26188	28	0.79247	18	25	
36	.61015	23	.63895	61	.77010	47	.29853	78	.26216	29	.79229	18	24	
37	.61038	23	.63834	62	.77057	46	.29775	79	.26245	28	.79211	18	23	
38	.61061	23	.63772	62	.77103	46	.29696	78	.26273	28	.79193	17	22	
39	.61084	23	.63710	62	.77149	47	.29618	77	.26301	29	.79176	18	21	
40	.61107	23	1.63648	61	0.77196	46	1.29541	78	1.26330	28	0.79158	18	20	
41	.61130	23	.63587	62	.77242	47	.29463	78	.26358	29	.79140	18	19	
42	.61153	23	.63525	61	.77289	46	.29385	78	.26387	28	.79122	17	18	
43	.61176	23	.63464	62	.77335	47	.29307	78	.26415	28	.79105	18	17	
44	.61199	23	.63402	61	.77382	46	.29229	77	.26443	29	.79087	18	16	
45	.61222	23	1.63341	62	0.77428	47	1.29152	78	1.26472	28	0.79069	18	15	
46	.61245	23	.63279	61	.77475	46	.29074	77	.26500	29	.79051	18	14	
47	.61268	23	.63218	61	.77521	47	.28997	78	.26529	28	.79033	17	13	
48	.61291	23	.63157	61	.77568	47	.28919	77	.26557	29	.79016	18	12	
49	.61314	23	.63096	61	.77615	46	.28842	78	.26586	29	.78998	18	11	
50	.61337	23	1.63035	61	0.77661	47	1.28764	77	1.26615	28	0.78980	18	10	
51	.61360	23	.62974	61	.77708	46	.28687	77	.26643	29	.78962	18	9	
52	.61383	23	.62913	61	.77754	47	.28610	77	.26672	29	.78944	18	8	
53	.61406	23	.62852	61	.77801	47	.28533	77	.26701	28	.78926	18	7	
54	.61429	22	.62791	61	.77848	47	.28456	77	.26729	29	.78908	17	6	
55	.61451	23	1.62730	61	0.77895	46	1.28379	77	1.26758	29	0.78891	18	5	
56	.61474	23	.62669	60	.77941	47	.28302	77	.26787	28	.78873	18	4	
57	.61497	23	.62609	61	.77988	47	.28225	77	.26815	29	.78855	18	3	
58	.61520	23	.62548	61	.78035	47	.28148	77	.26844	29	.78837	18	2	
59	.61543	23	.62487	60	.78082	47	.28071	77	.26873	29	.78819	18	1	
60	.61566	23	1.62427	60	0.78129	47	1.27994	77	1.26902	29	0.78801	18	0	
↑127°→	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	↑52°	

Natural Trigonometric Functions

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38° ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	141° ↑
0	0.61566	23	1.62427	61	0.78129	46	1.27994	77	1.26902	29	0.78801	18	60
1	.61589	23	.62366	60	.78175	47	.27917	76	.26931	29	.78783	18	59
2	.61612	23	.62306	60	.78222	47	.27841	77	.26960	28	.78765	18	58
3	.61635	23	.62246	61	.78269	47	.27764	76	.26988	29	.78747	18	57
4	.61658	23	.62185	60	.78316	47	.27688	77	.27017	29	.78729	18	56
5	0.61681	23	1.62125	60	0.78363	47	1.27611	76	1.27046	29	0.78711	17	55
6	.61704	22	.62065	60	.78410	47	.27535	77	.27075	29	.78694	18	54
7	.61726	23	.62005	60	.78457	47	.27458	76	.27104	29	.78676	18	53
8	.61749	23	.61945	60	.78504	47	.27382	76	.27133	29	.78658	18	52
9	.61772	23	.61885	60	.78551	47	.27306	76	.27162	29	.78640	18	51
10	0.61795	23	1.61825	60	0.78598	47	1.27230	77	1.27191	30	0.78622	18	50
11	.61818	23	.61765	60	.78645	47	.27153	76	.27221	29	.78604	18	49
12	.61841	23	.61705	59	.78692	47	.27077	76	.27250	29	.78586	18	48
13	.61864	23	.61646	60	.78739	47	.27001	76	.27279	29	.78568	18	47
14	.61887	22	.61586	60	.78786	48	.26925	76	.27308	29	.78550	18	46
15	0.61909	23	1.61526	59	0.78834	47	1.26849	75	1.27337	29	0.78532	18	45
16	.61932	23	.61467	60	.78881	47	.26774	76	.27366	30	.78514	18	44
17	.61955	23	.61407	59	.78928	47	.26698	76	.27396	29	.78496	18	43
18	.61978	23	.61348	60	.78975	47	.26622	76	.27425	29	.78478	18	42
19	.62001	23	.61288	59	.79022	48	.26546	75	.27454	29	.78460	18	41
20	0.62024	22	1.61229	59	0.79070	47	1.26471	76	1.27483	30	0.78442	18	40
21	.62046	23	.61170	59	.79117	47	.26395	76	.27513	29	.78424	19	39
22	.62069	23	.61111	60	.79164	48	.26319	75	.27542	30	.78405	18	38
23	.62092	23	.61051	59	.79212	47	.26244	75	.27572	29	.78387	18	37
24	.62115	23	.60992	59	.79259	47	.26169	76	.27601	29	.78369	18	36
25	0.62138	22	1.60933	59	0.79306	48	1.26093	75	1.27630	30	0.78351	18	35
26	.62160	23	.60874	59	.79354	47	.26018	75	.27660	29	.78333	18	34
27	.62183	23	.60815	59	.79401	48	.25943	76	.27689	30	.78315	18	33
28	.62206	23	.60756	58	.79449	47	.25867	75	.27719	29	.78297	18	32
29	.62229	22	.60698	59	.79496	48	.25792	75	.27748	30	.78279	18	31
30	0.62251	23	1.60639	59	0.79544	47	1.25717	75	1.27778	29	0.78261	18	30
31	.62274	23	.60580	59	.79591	48	.25642	75	.27807	30	.78243	18	29
32	.62297	23	.60521	58	.79639	47	.25567	75	.27837	30	.78225	18	28
33	.62320	22	.60463	59	.79686	48	.25492	75	.27867	29	.78206	18	27
34	.62342	23	.60404	58	.79734	47	.25417	74	.27896	30	.78188	18	26
35	0.62365	23	1.60346	59	0.79781	48	1.25343	75	1.27926	30	0.78170	18	25
36	.62388	23	.60287	58	.79829	48	.25268	75	.27956	29	.78152	18	24
37	.62411	22	.60229	58	.79877	47	.25193	75	.27985	30	.78134	18	23
38	.62433	23	.60171	59	.79924	48	.25118	74	.28015	30	.78116	18	22
39	.62456	23	.60112	58	.79972	48	.25044	75	.28045	30	.78098	19	21
40	0.62479	23	1.60054	58	0.80020	47	1.24969	74	1.28075	30	0.78079	18	20
41	.62502	22	.59996	58	.80067	48	.24895	75	.28105	29	.78061	18	19
42	.62524	23	.59938	58	.80115	48	.24820	74	.28134	30	.78043	18	18
43	.62547	23	.59880	58	.80163	48	.24746	74	.28164	30	.78025	18	17
44	.62570	22	.59822	58	.80211	47	.24672	75	.28194	30	.78007	19	16
45	0.62592	23	1.59764	58	0.80258	48	1.24597	74	1.28224	30	0.77988	18	15
46	.62615	23	.59706	58	.80306	48	.24523	74	.28254	30	.77970	18	14
47	.62638	22	.59648	58	.80354	48	.24449	74	.28284	30	.77952	18	13
48	.62660	23	.59590	57	.80402	48	.24375	74	.28314	30	.77934	18	12
49	.62683	23	.59533	58	.80450	48	.24301	74	.28344	30	.77916	19	11
50	0.62706	22	1.59475	57	0.80498	48	1.24227	74	1.28374	30	0.77897	18	10
51	.62728	23	.59418	58	.80546	48	.24153	74	.28404	30	.77879	18	9
52	.62751	23	.59360	58	.80594	48	.24079	74	.28434	30	.77861	18	8
53	.62774	23	.59302	57	.80642	48	.24005	74	.28464	31	.77843	19	7
54	.62796	22	.59245	57	.80690	48	.23931	73	.28495	30	.77824	18	6
55	0.62819	23	1.59188	58	0.80738	48	1.23858	74	1.28525	30	0.77806	18	5
56	.62842	22	.59130	57	.80786	48	.23784	74	.28555	30	.77788	19	4
57	.62864	23	.59073	57	.80834	48	.23710	73	.28585	30	.77769	18	3
58	.62887	23	.59016	57	.80882	48	.23637	74	.28615	31	.77751	18	2
59	.62909	22	.58959	57	.80930	48	.23563	73	.28646	30	.77733	18	1
60	0.62932	23	1.58902	57	0.80978	48	1.23490	73	1.28676	30	0.77715	18	0
↑ 128°	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1' ↓	51°

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Natural Trigonometric Functions

39° ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	←140° ↓
0	0.62932	23	1.58902	57	0.80978	49	1.23490	74	1.28676	30	0.77715	19	60
1	.62955	22	.58845	57	.81027	48	.23416	73	.28706	31	.77696	18	59
2	.62977	23	.58788	57	.81075	48	.23443	73	.28737	30	.77678	18	58
3	.63000	22	.58731	57	.81123	48	.23270	74	.28767	30	.77660	19	57
4	.63022	23	.58674	57	.81171	49	.23196	73	.28797	31	.77641	18	56
5	0.63045	23	1.58617	57	0.81220	48	1.23123	73	1.28828	30	0.77623	18	55
6	.63068	22	.58560	57	.81268	48	.23050	73	.28858	31	.77605	19	54
7	.63090	23	.58503	56	.81316	48	.22977	73	.28889	30	.77586	18	53
8	.63113	22	.58447	57	.81364	49	.22904	73	.28919	31	.77568	18	52
9	.63135	23	.58390	57	.81413	48	.22831	73	.28950	30	.77550	19	51
10	0.63158	22	1.58333	56	0.81461	49	1.22758	73	1.28980	31	0.77531	18	50
11	.63180	23	.58277	56	.81510	48	.22685	73	.29011	31	.77513	19	49
12	.63203	22	.58221	57	.81558	48	.22612	73	.29042	30	.77494	18	48
13	.63225	23	.58164	56	.81606	49	.22539	72	.29072	31	.77476	18	47
14	.63248	23	.58108	57	.81655	48	.22467	73	.29103	30	.77458	19	46
15	0.63271	22	1.58051	56	0.81703	49	1.22394	73	1.29133	31	0.77439	18	45
16	.63293	23	.57995	56	.81752	48	.22321	72	.29164	31	.77421	19	44
17	.63316	22	.57939	56	.81800	49	.22249	73	.29195	31	.77402	18	43
18	.63338	23	.57883	56	.81849	49	.22176	72	.29226	30	.77384	18	42
19	.63361	22	.57827	56	.81898	48	.22104	73	.29256	31	.77366	19	41
20	0.63383	23	1.57771	56	0.81946	49	1.22031	72	1.29287	31	0.77347	18	40
21	.63406	22	.57715	56	.81995	49	.21959	73	.29318	31	.77329	19	39
22	.63428	23	.57659	56	.82044	48	.21886	72	.29349	31	.77310	18	38
23	.63451	22	.57603	56	.82092	49	.21814	72	.29380	31	.77292	19	37
24	.63473	23	.57547	56	.82141	49	.21742	72	.29411	31	.77273	18	36
25	0.63496	22	1.57491	55	0.82190	48	1.21670	72	1.29442	31	0.77255	19	35
26	.63518	22	.57436	56	.82238	49	.21598	72	.29473	31	.77236	18	34
27	.63540	23	.57380	56	.82287	49	.21526	72	.29504	31	.77218	19	33
28	.63563	22	.57324	55	.82336	49	.21454	72	.29535	31	.77199	18	32
29	.63585	23	.57269	56	.82385	49	.21382	72	.29566	31	.77181	19	31
30	0.63608	22	1.57213	55	0.82434	49	1.21310	72	1.29597	31	0.77162	18	30
31	.63630	23	.57158	55	.82483	48	.21238	72	.29628	31	.77144	19	29
32	.63653	22	.57103	56	.82531	49	.21166	72	.29659	31	.77125	18	28
33	.63676	23	.57047	55	.82580	49	.21094	71	.29690	31	.77107	19	27
34	.63698	22	.56992	55	.82629	49	.21023	72	.29721	31	.77088	18	26
35	0.63720	22	1.56937	56	0.82678	49	1.20951	72	1.29752	32	0.77070	19	25
36	.63742	23	.56881	55	.82727	49	.20879	71	.29784	31	.77051	18	24
37	.63765	22	.56826	55	.82776	49	.20808	72	.29815	31	.77033	19	23
38	.63787	23	.56771	55	.82825	49	.20736	71	.29846	31	.77014	18	22
39	.63810	22	.56716	55	.82874	49	.20665	72	.29877	32	.76996	19	21
40	0.63832	22	1.56661	55	0.82923	49	1.20593	71	1.29909	31	0.76977	18	20
41	.63854	23	.56606	55	.82972	50	.20522	71	.29940	31	.76959	19	19
42	.63877	22	.56551	54	.83022	49	.20451	72	.29971	31	.76940	19	18
43	.63899	23	.56497	55	.83071	49	.20379	71	.30003	31	.76921	18	17
44	.63922	22	.56442	55	.83120	49	.20308	71	.30034	32	.76903	19	16
45	0.63944	22	1.56387	55	0.83169	49	1.20237	71	1.30066	31	0.76884	18	15
46	.63966	23	.56332	54	.83218	50	.20166	71	.30097	32	.76866	19	14
47	.63989	22	.56278	55	.83268	49	.20095	71	.30129	31	.76847	19	13
48	.64011	22	.56223	54	.83317	49	.20024	71	.30160	32	.76828	18	12
49	.64033	23	.56169	55	.83366	49	.19953	71	.30192	31	.76810	19	11
50	0.64056	22	1.56114	54	0.83415	50	1.19882	71	1.30223	32	0.76791	19	10
51	.64078	22	.56060	55	.83465	49	.19811	71	.30255	32	.76772	18	9
52	.64100	23	.56005	54	.83514	50	.19740	71	.30287	31	.76754	19	8
53	.64123	22	.55951	54	.83564	49	.19669	70	.30318	32	.76735	18	7
54	.64145	22	.55897	54	.83613	49	.19599	71	.30350	32	.76717	19	6
55	0.64167	23	1.55843	54	0.83662	50	1.19528	71	1.30382	31	0.76698	19	5
56	.64190	22	.55789	55	.83712	49	.19457	70	.30413	32	.76679	18	4
57	.64212	22	.55734	54	.83761	50	.19387	71	.30445	32	.76661	19	3
58	.64234	22	.55680	54	.83811	49	.19316	70	.30477	32	.76642	19	2
59	.64256	23	.55626	54	.83860	50	.19246	71	.30509	32	.76623	19	1
60	0.64279	23	1.55572	54	0.83910	50	1.19175	71	1.30541	32	0.76604	19	0
↑129°	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'←	50°

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Natural Trigonometric Functions

40°		Diff.		sec		Diff.		cot		Diff.		tan		Diff.		tan		Diff.		sec		Diff.		cos		Diff.		sin		Diff.									
↑	130°	1'	1'	1'	1'	1'	1'	1'	1'	1'	1'	1'	1'	1'	1'	1'	1'	1'	1'	1'	1'	1'	1'	1'	1'	1'	1'	1'	1'	1'	1'								
0	0.64279	22	1.55572	54	0.83910	50	1.19175	70	1.30541	32	0.76604	18	60	0.64279	22	1.55572	54	0.83910	50	1.19175	70	1.30541	32	0.76604	18	60	0.64279	22	1.55572	54	0.83910	50	1.19175	70	1.30541	32	0.76604	18	60
1	0.64301	22	1.55518	53	0.83960	49	1.19105	70	1.30573	32	0.76586	19	59	0.64301	22	1.55518	53	0.83960	49	1.19105	70	1.30573	32	0.76586	19	59	0.64301	22	1.55518	53	0.83960	49	1.19105	70	1.30573	32	0.76586	19	59
2	0.64323	23	1.55465	54	0.84009	50	1.19035	71	1.30605	31	0.76567	19	58	0.64323	23	1.55465	54	0.84009	50	1.19035	71	1.30605	31	0.76567	19	58	0.64323	23	1.55465	54	0.84009	50	1.19035	71	1.30605	31	0.76567	19	58
3	0.64346	22	1.55411	54	0.84059	49	1.18964	70	1.30636	32	0.76548	18	57	0.64346	22	1.55411	54	0.84059	49	1.18964	70	1.30636	32	0.76548	18	57	0.64346	22	1.55411	54	0.84059	49	1.18964	70	1.30636	32	0.76548	18	57
4	0.64368	22	1.55357	54	0.84108	50	1.18894	70	1.30668	32	0.76530	19	56	0.64368	22	1.55357	54	0.84108	50	1.18894	70	1.30668	32	0.76530	19	56	0.64368	22	1.55357	54	0.84108	50	1.18894	70	1.30668	32	0.76530	19	56
5	0.64390	22	1.55303	53	0.84158	50	1.18824	70	1.30700	32	0.76511	19	55	0.64390	22	1.55303	53	0.84158	50	1.18824	70	1.30700	32	0.76511	19	55	0.64390	22	1.55303	53	0.84158	50	1.18824	70	1.30700	32	0.76511	19	55
6	0.64412	23	1.55250	54	0.84208	50	1.18754	70	1.30732	32	0.76492	19	54	0.64412	23	1.55250	54	0.84208	50	1.18754	70	1.30732	32	0.76492	19	54	0.64412	23	1.55250	54	0.84208	50	1.18754	70	1.30732	32	0.76492	19	54
7	0.64435	22	1.55196	53	0.84258	49	1.18684	70	1.30764	32	0.76473	18	53	0.64435	22	1.55196	53	0.84258	49	1.18684	70	1.30764	32	0.76473	18	53	0.64435	22	1.55196	53	0.84258	49	1.18684	70	1.30764	32	0.76473	18	53
8	0.64457	22	1.55143	54	0.84307	50	1.18614	70	1.30796	33	0.76455	19	52	0.64457	22	1.55143	54	0.84307	50	1.18614	70	1.30796	33	0.76455	19	52	0.64457	22	1.55143	54	0.84307	50	1.18614	70	1.30796	33	0.76455	19	52
9	0.64479	22	1.55089	53	0.84357	50	1.18544	70	1.30829	32	0.76436	19	51	0.64479	22	1.55089	53	0.84357	50	1.18544	70	1.30829	32	0.76436	19	51	0.64479	22	1.55089	53	0.84357	50	1.18544	70	1.30829	32	0.76436	19	51
10	0.64501	23	1.55036	54	0.84407	50	1.18474	70	1.30861	32	0.76417	19	50	0.64501	23	1.55036	54	0.84407	50	1.18474	70	1.30861	32	0.76417	19	50	0.64501	23	1.55036	54	0.84407	50	1.18474	70	1.30861	32	0.76417	19	50
11	0.64524	22	1.54982	53	0.84457	50	1.18404	70	1.30893	32	0.76398	18	49	0.64524	22	1.54982	53	0.84457	50	1.18404	70	1.30893	32	0.76398	18	49	0.64524	22	1.54982	53	0.84457	50	1.18404	70	1.30893	32	0.76398	18	49
12	0.64546	22	1.54929	53	0.84507	49	1.18334	70	1.30925	32	0.76380	19	48	0.64546	22	1.54929	53	0.84507	49	1.18334	70	1.30925	32	0.76380	19	48	0.64546	22	1.54929	53	0.84507	49	1.18334	70	1.30925	32	0.76380	19	48
13	0.64568	22	1.54876	54	0.84556	50	1.18264	70	1.30957	32	0.76361	19	47	0.64568	22	1.54876	54	0.84556	50	1.18264	70	1.30957	32	0.76361	19	47	0.64568	22	1.54876	54	0.84556	50	1.18264	70	1.30957	32	0.76361	19	47
14	0.64590	22	1.54822	53	0.84606	50	1.18194	69	1.30989	33	0.76342	19	46	0.64590	22	1.54822	53	0.84606	50	1.18194	69	1.30989	33	0.76342	19	46	0.64590	22	1.54822	53	0.84606	50	1.18194	69	1.30989	33	0.76342	19	46
15	0.64612	23	1.54769	53	0.84656	50	1.18125	70	1.31022	32	0.76323	19	45	0.64612	23	1.54769	53	0.84656	50	1.18125	70	1.31022	32	0.76323	19	45	0.64612	23	1.54769	53	0.84656	50	1.18125	70	1.31022	32	0.76323	19	45
16	0.64635	22	1.54716	53	0.84706	50	1.18055	69	1.31054	32	0.76304	18	44	0.64635	22	1.54716	53	0.84706	50	1.18055	69	1.31054	32	0.76304	18	44	0.64635	22	1.54716	53	0.84706	50	1.18055	69	1.31054	32	0.76304	18	44
17	0.64657	22	1.54663	53	0.84756	50	1.17986	70	1.31086	33	0.76286	19	43	0.64657	22	1.54663	53	0.84756	50	1.17986	70	1.31086	33	0.76286	19	43	0.64657	22	1.54663	53	0.84756	50	1.17986	70	1.31086	33	0.76286	19	43
18	0.64679	22	1.54610	53	0.84806	50	1.17916	70	1.31119	32	0.76267	19	42	0.64679	22	1.54610	53	0.84806	50	1.17916	70	1.31119	32	0.76267	19	42	0.64679	22	1.54610	53	0.84806	50	1.17916	70	1.31119	32	0.76267	19	42
19	0.64701	22	1.54557	53	0.84856	50	1.17846	69	1.31151	32	0.76248	19	41	0.64701	22	1.54557	53	0.84856	50	1.17846	69	1.31151	32	0.76248	19	41	0.64701	22	1.54557	53	0.84856	50	1.17846	69	1.31151	32	0.76248	19	41
20	0.64723	23	1.54504	53	0.84906	50	1.17777	69	1.31183	33	0.76229	19	40	0.64723	23	1.54504	53	0.84906	50	1.17777	69	1.31183	33	0.76229	19	40	0.64723	23	1.54504	53	0.84906	50	1.17777	69	1.31183	33	0.76229	19	40
21	0.64746	22	1.54451	53	0.84956	50	1.17708	70	1.31216	32	0.76210	18	39	0.64746	22	1.54451	53	0.84956	50	1.17708	70	1.31216	32	0.76210	18	39	0.64746	22	1.54451	53	0.84956	50	1.17708	70	1.31216	32	0.76210	18	39
22	0.64768	22	1.54398	53	0.85006	50	1.17638	69	1.31248	33	0.76192	19	38	0.64768	22	1.54398	53	0.85006	50	1.17638	69	1.31248	33	0.76192	19	38	0.64768	22	1.54398	53	0.85006	50	1.17638	69	1.31248	33	0.76192	19	38
23	0.64790	22	1.54345	53	0.85057	51	1.17569	69	1.31281	33	0.76173	19	37	0.64790	22	1.54345	53	0.85057	51	1.17569	69	1.31281	33	0.76173	19	37	0.64790	22	1.54345	53	0.85057	51	1.17569	69	1.31281	33	0.76173	19	37
24	0.64812	22	1.54292	52	0.85107	50	1.17500	70	1.31313	33	0.76154	19	36	0.64812	22	1.54292	52	0.85107	50	1.17500	70	1.31313	33	0.76154	19	36	0.64812	22	1.54292	52	0.85107	50	1.17500	70	1.31313	33	0.76154	19	36
25	0.64834	22	1.54240	53	0.85157	50	1.17430	69	1.31346	32	0.76135	19	35	0.64834	22	1.54240	53	0.85157	50	1.17430	69	1.31346	32	0.76135	19	35	0.64834	22	1.54240	53	0.85157	50	1.17430	69	1.31346	32	0.76135	19	35
26	0.64856	22	1.54187	53	0.85207	50	1.17361	69	1.31378	33	0.76116	19	34	0.64856	22	1.54187	53	0.85207	50	1.17361	69	1.31378	33	0.76116	19	34	0.64856	22	1.54187	53	0.85207	50	1.17361	69	1.31378	33	0.76116	19	34
27	0.64878	23	1.54134	52	0.85257	50	1.17292	69	1.31411	32	0.76097	19	33	0.64878	23	1.54134	52	0.85257	50	1.17292	69	1.31411	32	0.76097	19	33	0.64878	23	1.54134	52	0.85257	50	1.17292	69	1.31411	32	0.76097	19	33
28	0.64901	22	1.54082	53	0.85308	50	1.17223	69	1.31443	33	0.76078	19	32	0.64901	22	1.54082	53	0.85308	50	1.17223	69	1.31443	33	0.76078	19	32	0.64901	22	1.54082	53	0.85308	50	1.17223	69	1.31443	33	0.76078	19	32
29	0.64923	22	1.54029	52	0.85358	50	1.17154	69	1.31476	33	0.76059	18	31	0.64923	22	1.54029	52	0.85358	50	1.17154	69	1.31476	33	0.76059	18	31	0.64923	22	1.54029	52	0.85358	50	1.17154	69	1.31476	33	0.76059	18	31
30	0.64945	22	1.53977	53	0.85408	50	1.17085	69	1.31509	32	0.76041	19	30	0.64945	22	1.53977	53	0.85408	50	1.17085	69	1.31509	32	0.76041	19	30	0.64945	22	1.53977	53	0.85408	50	1.17085	69	1.31509	32	0.76041	19	30
31	0.64967	22	1.53924	52																																			

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Natural Trigonometric Functions

41° ↑		Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	↑ 138°
sin													
0	0.65606	22	1.52425	51	0.86929	51	1.15037	68	1.32501	34	0.75471	19	60
1	0.65628	22	1.52374	51	0.86980	51	1.14969	67	32535	33	75452	19	59
2	0.65650	22	1.52323	50	0.87031	51	1.14902	68	32568	34	75433	19	58
3	0.65672	22	1.52273	51	0.87082	51	1.14834	67	32602	34	75414	19	57
4	0.65694	22	1.52222	51	0.87133	51	1.14767	68	32636	33	75395	20	56
5	0.65716	22	1.52171	51	0.87184	52	1.14699	67	1.32669	34	0.75375	19	55
6	0.65738	21	1.52120	51	0.87236	51	1.14632	67	32703	34	75356	19	54
7	0.65759	22	1.52069	50	0.87287	51	1.14565	67	32737	33	75337	19	53
8	0.65781	22	1.52019	51	0.87338	51	1.14498	68	32770	34	75318	19	52
9	0.65803	22	1.51968	50	0.87389	52	1.14430	67	32804	34	75299	19	51
10	0.65825	22	1.51918	51	0.87441	51	1.14363	67	1.32838	34	0.75280	19	50
11	0.65847	22	1.51867	50	0.87492	51	1.14296	67	32872	33	75261	20	49
12	0.65869	22	1.51817	51	0.87543	52	1.14229	67	32905	34	75241	20	48
13	0.65891	22	1.51766	50	0.87595	51	1.14162	67	32939	34	75222	19	47
14	0.65913	22	1.51716	51	0.87646	52	1.14095	67	32973	34	75203	19	46
15	0.65935	21	1.51665	50	0.87698	51	1.14028	67	1.33007	34	0.75184	19	45
16	0.65958	22	1.51615	50	0.87749	52	1.13961	67	33041	34	75165	19	44
17	0.65978	22	1.51565	50	0.87801	51	1.13894	66	33075	34	75146	20	43
18	0.66000	22	1.51515	50	0.87852	52	1.13828	67	33109	34	75126	20	42
19	0.66022	22	1.51465	50	0.87904	51	1.13761	67	33143	34	75107	19	41
20	0.66044	22	1.51415	51	0.87955	52	1.13694	67	1.33177	34	0.75088	19	40
21	0.66066	22	1.51364	50	0.88007	52	1.13627	66	33211	34	75069	19	39
22	0.66088	22	1.51314	49	0.88059	51	1.13561	67	33245	34	75050	20	38
23	0.66109	21	1.51265	50	0.88110	52	1.13494	66	33279	35	75030	19	37
24	0.66131	22	1.51215	50	0.88162	52	1.13428	67	33314	34	75011	19	36
25	0.66153	22	1.51165	50	0.88214	51	1.13361	66	1.33348	34	0.74992	19	35
26	0.66175	22	1.51115	50	0.88265	52	1.13295	67	33382	34	74973	20	34
27	0.66197	22	1.51065	50	0.88317	52	1.13228	66	33416	35	74953	19	33
28	0.66218	21	1.51015	49	0.88369	52	1.13162	66	33451	34	74934	19	32
29	0.66240	22	1.50966	50	0.88421	52	1.13096	67	33485	34	74915	19	31
30	0.66262	22	1.50916	50	0.88473	51	1.13029	66	1.33519	35	0.74896	20	30
31	0.66284	22	1.50866	49	0.88524	52	1.12963	66	33554	34	74877	19	29
32	0.66306	21	1.50816	49	0.88576	52	1.12897	66	33588	34	74857	19	28
33	0.66327	21	1.50767	49	0.88628	52	1.12831	66	33622	35	74838	20	27
34	0.66349	22	1.50718	49	0.88680	52	1.12765	66	33657	34	74818	19	26
35	0.66371	22	1.50669	50	0.88732	52	1.12699	66	1.33691	35	0.74799	19	25
36	0.66393	21	1.50619	49	0.88784	52	1.12633	66	33726	34	74780	20	24
37	0.66414	22	1.50570	49	0.88836	52	1.12567	66	33760	35	74760	19	23
38	0.66436	22	1.50521	50	0.88888	52	1.12501	66	33795	35	74741	19	22
39	0.66458	22	1.50471	49	0.88940	52	1.12435	66	33830	34	74722	19	21
40	0.66480	21	1.50422	49	0.88992	53	1.12369	66	1.33864	35	0.74703	20	20
41	0.66501	22	1.50373	49	0.89045	52	1.12303	65	33899	35	74683	19	19
42	0.66523	22	1.50324	49	0.89097	52	1.12238	66	33934	34	74664	20	18
43	0.66545	21	1.50275	49	0.89149	52	1.12172	66	33968	35	74644	19	17
44	0.66566	22	1.50226	49	0.89201	52	1.12106	65	34003	35	74625	19	16
45	0.66588	22	1.50177	49	0.89253	53	1.12041	66	1.34038	35	0.74606	20	15
46	0.66610	22	1.50128	49	0.89306	52	1.11975	66	34073	35	74586	19	14
47	0.66632	21	1.50079	49	0.89358	52	1.11909	65	34108	34	74567	19	13
48	0.66653	22	1.50030	49	0.89410	53	1.11844	65	34142	35	74548	20	12
49	0.66675	22	1.49981	48	0.89463	52	1.11778	65	34177	35	74528	19	11
50	0.66697	21	1.49933	49	0.89515	52	1.11713	65	1.34212	35	0.74509	20	10
51	0.66718	22	1.49884	49	0.89567	53	1.11648	66	34247	35	74489	19	9
52	0.66740	22	1.49835	48	0.89620	53	1.11582	66	34282	35	74470	19	8
53	0.66762	22	1.49787	48	0.89672	53	1.11517	65	34317	35	74451	20	7
54	0.66783	22	1.49738	48	0.89725	52	1.11452	65	34352	35	74431	19	6
55	0.66805	22	1.49690	49	0.89777	53	1.11387	66	1.34387	36	0.74412	20	5
56	0.66827	21	1.49641	48	0.89830	53	1.11321	65	34423	35	74392	19	4
57	0.66848	22	1.49593	48	0.89883	53	1.11256	65	34458	35	74373	20	3
58	0.66870	22	1.49544	48	0.89935	53	1.11191	65	34493	35	74353	19	2
59	0.66891	22	1.49496	48	0.89988	53	1.11126	65	34528	35	74334	19	1
60	0.66913	22	1.49448	48	0.90040	52	1.11061	65	1.34563	35	0.74314	20	0

Natural Trigonometric Functions

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42° ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	↑ 137°
0	0.66913	22	1.49448	49	0.90040	53	1.11061	65	1.34563	36	0.74314	19	60
1	.66935	21	.49399	48	.90093	53	.10996	65	.34599	35	.74295	19	59
2	.66956	21	.49351	48	.90146	53	.10931	64	.34634	35	.74276	20	58
3	.66978	21	.49303	48	.90199	52	.10867	65	.34669	35	.74256	19	57
4	.66999	22	.49255	48	.90251	53	.10802	65	.34704	36	.74237	20	56
5	0.67021	22	1.49207	48	0.90304	53	1.10737	65	1.34740	35	0.74217	19	55
6	.67043	21	.49159	48	.90357	53	.10672	65	.34775	35	.74198	20	54
7	.67064	22	.49111	48	.90410	53	.10607	64	.34811	35	.74178	19	53
8	.67086	21	.49063	48	.90463	53	.10543	65	.34846	36	.74159	20	52
9	.67107	22	.49015	48	.90516	53	.10478	64	.34882	35	.74139	19	51
10	0.67129	22	1.48967	48	0.90569	52	1.10414	65	1.34917	36	0.74120	20	50
11	.67151	21	.48919	48	.90621	53	.10349	64	.34953	35	.74100	19	49
12	.67172	22	.48871	47	.90674	53	.10285	65	.34988	36	.74080	20	48
13	.67194	21	.48824	48	.90727	54	.10220	64	.35024	36	.74061	19	47
14	.67215	22	.48776	48	.90781	53	.10156	65	.35060	35	.74041	20	46
15	0.67237	21	1.48728	47	0.90834	53	1.10091	64	1.35095	36	0.74022	19	45
16	.67258	22	.48681	48	.90887	53	.10027	64	.35131	36	.74002	20	44
17	.67280	21	.48633	47	.90940	53	.09963	64	.35167	36	.73983	19	43
18	.67301	22	.48586	48	.90993	53	.09899	65	.35203	35	.73963	20	42
19	.67323	21	.48538	47	.91046	53	.09834	64	.35238	36	.73944	19	41
20	0.67344	22	1.48491	48	0.91099	54	1.09770	64	1.35274	36	0.73924	20	40
21	.67366	21	.48443	47	.91153	53	.09706	64	.35310	36	.73904	19	39
22	.67387	22	.48396	47	.91206	53	.09642	64	.35346	36	.73885	20	38
23	.67409	21	.48349	48	.91259	54	.09578	64	.35382	36	.73865	19	37
24	.67430	22	.48301	47	.91313	53	.09514	64	.35418	36	.73846	20	36
25	0.67452	21	1.48254	47	0.91366	53	1.09450	64	1.35454	36	0.73826	19	35
26	.67473	22	.48207	47	.91419	54	.09386	64	.35490	36	.73806	20	34
27	.67495	21	.48160	47	.91473	53	.09322	64	.35526	36	.73787	19	33
28	.67516	22	.48113	47	.91526	54	.09258	63	.35562	36	.73767	20	32
29	.67538	21	.48066	47	.91580	53	.09195	64	.35598	36	.73747	19	31
30	0.67559	21	1.48019	47	0.91633	54	1.09131	64	1.35634	36	0.73728	20	30
31	.67580	22	.47972	47	.91687	53	.09067	64	.35670	37	.73708	19	29
32	.67602	21	.47925	47	.91740	54	.09003	63	.35707	37	.73688	20	28
33	.67623	22	.47878	47	.91794	53	.08940	64	.35743	36	.73669	19	27
34	.67645	21	.47831	47	.91847	54	.08876	63	.35779	36	.73649	20	26
35	0.67666	22	1.47784	46	0.91901	54	1.08813	64	1.35815	37	0.73629	19	25
36	.67688	21	.47738	47	.91955	53	.08749	63	.35852	36	.73610	20	24
37	.67709	21	.47691	47	.92008	54	.08686	64	.35888	36	.73590	19	23
38	.67730	22	.47644	46	.92062	54	.08622	63	.35924	37	.73570	20	22
39	.67752	21	.47598	47	.92116	54	.08559	63	.35961	36	.73551	19	21
40	0.67773	22	1.47551	47	0.92170	54	1.08496	64	1.35997	37	0.73531	20	20
41	.67795	21	.47504	46	.92224	53	.08432	63	.36034	36	.73511	19	19
42	.67816	21	.47458	47	.92277	54	.08369	63	.36070	37	.73491	20	18
43	.67837	22	.47411	46	.92331	54	.08306	63	.36107	36	.73472	19	17
44	.67859	21	.47365	46	.92385	54	.08243	64	.36143	37	.73452	20	16
45	0.67880	21	1.47319	47	0.92439	54	1.08179	63	1.36180	37	0.73432	19	15
46	.67901	22	.47272	46	.92493	54	.08116	63	.36217	36	.73413	20	14
47	.67923	21	.47226	46	.92547	54	.08053	63	.36253	37	.73393	19	13
48	.67944	21	.47180	46	.92601	54	.07990	63	.36290	37	.73373	20	12
49	.67965	22	.47134	47	.92655	54	.07927	63	.36327	36	.73353	19	11
50	0.67987	21	1.47087	46	0.92709	54	1.07864	63	1.36363	37	0.73333	20	10
51	.68008	21	.47041	46	.92763	54	.07801	63	.36400	37	.73314	19	9
52	.68029	22	.46995	46	.92817	55	.07738	62	.36437	37	.73294	20	8
53	.68051	21	.46949	46	.92872	54	.07676	63	.36474	37	.73274	19	7
54	.68072	21	.46903	46	.92926	54	.07613	63	.36511	37	.73254	20	6
55	0.68093	22	1.46857	46	0.92980	54	1.07550	63	1.36548	37	0.73234	19	5
56	.68115	21	.46811	46	.93034	54	.07487	62	.36585	37	.73215	20	4
57	.68136	21	.46765	46	.93088	55	.07425	63	.36622	37	.73195	19	3
58	.68157	22	.46719	45	.93143	54	.07362	63	.36659	37	.73175	20	2
59	.68179	21	.46674	46	.93197	55	.07299	62	.36696	37	.73155	19	1
60	0.68200	21	1.46628	46	0.93252	55	1.07237	62	1.36733	37	0.73135	20	0
↑ 132°	cos	Diff. 1'	sec	Diff. 1'	cot	Diff. 1'	tan	Diff. 1'	csc	Diff. 1'	sin	Diff. 1'	↑ 47°

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Natural Trigonometric Functions

43° ↓	sin	Diff. 1'	csc	Diff. 1'	tan	Diff. 1'	cot	Diff. 1'	sec	Diff. 1'	cos	Diff. 1'	←136° ↓
0	0.68200	21	1.46628	46	0.93252	54	1.07237	63	1.36733	37	0.73135	19	60
1	.68221	21	.46582	45	.93306	54	.07174	62	.36770	37	.73116	20	59
2	.68242	22	.46537	46	.93360	55	.07112	63	.36807	37	.73096	20	58
3	.68264	21	.46491	46	.93415	54	.07049	62	.36844	37	.73076	20	57
4	.68285	21	.46445	45	.93469	55	.06987	62	.36881	38	.73056	20	56
5	0.68306	21	1.46400	46	0.93524	54	1.06925	63	1.36919	37	0.73036	20	55
6	.68327	22	.46354	45	.93578	55	.06862	62	.36956	37	.73016	20	54
7	.68349	21	.46309	46	.93633	55	.06800	62	.36993	37	.72996	20	53
8	.68370	21	.46263	45	.93688	54	.06738	62	.37030	38	.72976	19	52
9	.68391	21	.46218	45	.93742	55	.06676	63	.37068	37	.72957	20	51
10	0.68412	22	1.46173	46	0.93797	55	1.06613	62	1.37105	38	0.72937	20	50
11	.68434	21	.46127	45	.93852	54	.06551	62	.37143	37	.72917	20	49
12	.68455	21	.46082	45	.93906	55	.06489	62	.37180	38	.72897	20	48
13	.68476	21	.46037	45	.93961	55	.06427	62	.37218	37	.72877	20	47
14	.68497	21	.45992	46	.94016	55	.06365	62	.37255	38	.72857	20	46
15	0.68518	21	1.45946	45	0.94071	54	1.06303	62	1.37293	37	0.72837	20	45
16	.68539	22	.45901	45	.94125	55	.06241	62	.37330	38	.72817	20	44
17	.68561	21	.45856	45	.94180	55	.06179	62	.37368	38	.72797	20	43
18	.68582	21	.45811	45	.94235	55	.06117	61	.37406	37	.72777	20	42
19	.68603	21	.45766	45	.94290	55	.06056	62	.37443	38	.72757	20	41
20	0.68624	21	1.45721	45	0.94345	55	1.05994	62	1.37481	38	0.72737	20	40
21	.68645	21	.45676	45	.94400	55	.05932	62	.37519	37	.72717	20	39
22	.68666	22	.45631	44	.94455	55	.05870	61	.37556	38	.72697	20	38
23	.68688	21	.45587	45	.94510	55	.05809	62	.37594	38	.72677	20	37
24	.68709	21	.45542	45	.94565	55	.05747	62	.37632	38	.72657	20	36
25	0.68730	21	1.45497	45	0.94620	56	1.05685	61	1.37670	38	0.72637	20	35
26	.68751	21	.45452	44	.94676	55	.05624	62	.37708	38	.72617	20	34
27	.68772	21	.45408	45	.94731	55	.05562	61	.37746	38	.72597	20	33
28	.68793	21	.45363	44	.94786	55	.05501	62	.37784	38	.72577	20	32
29	.68814	21	.45319	45	.94841	55	.05439	61	.37822	38	.72557	20	31
30	0.68835	22	1.45274	45	0.94896	56	1.05378	61	1.37860	38	0.72537	20	30
31	.68857	21	.45229	44	.94952	55	.05317	62	.37898	38	.72517	20	29
32	.68878	21	.45185	44	.95007	55	.05255	61	.37936	38	.72497	20	28
33	.68899	21	.45141	45	.95062	56	.05194	61	.37974	38	.72477	20	27
34	.68920	21	.45096	44	.95118	55	.05133	61	.38012	39	.72457	20	26
35	0.68941	21	1.45052	45	0.95173	56	1.05072	62	1.38051	38	0.72437	20	25
36	.68962	21	.45007	44	.95229	55	.05010	61	.38089	38	.72417	20	24
37	.68983	21	.44963	44	.95284	56	.04949	61	.38127	38	.72397	20	23
38	.69004	21	.44919	44	.95340	55	.04888	61	.38165	39	.72377	20	22
39	.69025	21	.44875	44	.95395	56	.04827	61	.38204	38	.72357	20	21
40	0.69046	21	1.44831	44	0.95451	55	1.04766	61	1.38242	38	0.72337	20	20
41	.69067	21	.44787	45	.95506	56	.04705	61	.38280	39	.72317	20	19
42	.69088	21	.44742	44	.95562	56	.04644	61	.38319	38	.72297	20	18
43	.69109	21	.44698	44	.95618	55	.04583	61	.38357	39	.72277	20	17
44	.69130	21	.44654	44	.95673	56	.04522	61	.38396	38	.72257	21	16
45	0.69151	21	1.44610	43	0.95729	56	1.04461	60	1.38434	39	0.72236	20	15
46	.69172	21	.44567	44	.95785	56	.04401	61	.38473	39	.72216	20	14
47	.69193	21	.44523	44	.95841	56	.04340	61	.38512	38	.72196	20	13
48	.69214	21	.44479	44	.95897	55	.04279	61	.38550	39	.72176	20	12
49	.69235	21	.44435	44	.95952	56	.04218	60	.38589	39	.72156	20	11
50	0.69256	21	1.44391	44	0.96008	56	1.04158	61	1.38628	38	0.72136	20	10
51	.69277	21	.44347	43	.96064	56	.04097	61	.38666	39	.72116	21	9
52	.69298	21	.44304	44	.96120	56	.04036	60	.38705	39	.72095	20	8
53	.69319	21	.44260	43	.96176	56	.03976	61	.38744	39	.72075	20	7
54	.69340	21	.44217	44	.96232	56	.03915	60	.38783	39	.72055	20	6
55	0.69361	21	1.44173	44	0.96288	56	1.03855	61	1.38822	38	0.72035	20	5
56	.69382	21	.44129	43	.96344	56	.03794	60	.38860	39	.72015	20	4
57	.69403	21	.44086	44	.96400	57	.03734	60	.38899	39	.71995	21	3
58	.69424	21	.44042	43	.96457	56	.03674	61	.38938	39	.71974	20	2
59	.69445	21	.43999	43	.96513	56	.03613	60	.38977	39	.71954	20	1
60	0.69466	21	1.43956	43	0.96569	56	1.03553	60	1.39016	39	0.71934	20	0
↑		Diff. 1'		Diff. 1'		Diff. 1'		Diff. 1'		Diff. 1'		Diff. 1'	↑
			sec		cot		tan		csc		sin		46°

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245 159

(37)

Logarithms of Numbers

1-250

No.	Log	No.	Log	No.	Log	No.	Log	No.	Log
1	0.00000	51	1.70757	101	2.00432	151	2.17898	201	2.30320
2	0.30103	52	1.71600	102	2.00860	152	2.18184	202	2.30535
3	0.47712	53	1.72428	103	2.01284	153	2.18469	203	2.30750
4	0.60206	54	1.73239	104	2.01703	154	2.18752	204	2.30963
5	0.69897	55	1.74036	105	2.02119	155	2.19033	205	2.31175
6	0.77815	56	1.74819	106	2.02531	156	2.19312	206	2.31387
7	0.84510	57	1.75587	107	2.02938	157	2.19590	207	2.31597
8	0.90309	58	1.76343	108	2.03342	158	2.19866	208	2.31806
9	0.95424	59	1.77085	109	2.03743	159	2.20140	209	2.32015
10	1.00000	60	1.77815	110	2.04139	160	2.20412	210	2.32222
11	1.04139	61	1.78533	111	2.04532	161	2.20683	211	2.32428
12	1.07918	62	1.79239	112	2.04922	162	2.20952	212	2.32634
13	1.11394	63	1.79934	113	2.05308	163	2.21219	213	2.32838
14	1.14613	64	1.80618	114	2.05690	164	2.21484	214	2.33041
15	1.17609	65	1.81291	115	2.06070	165	2.21748	215	2.33244
16	1.20412	66	1.81954	116	2.06446	166	2.22011	216	2.33445
17	1.23045	67	1.82607	117	2.06819	167	2.22272	217	2.33646
18	1.25527	68	1.83251	118	2.07188	168	2.22531	218	2.33846
19	1.27875	69	1.83885	119	2.07555	169	2.22789	219	2.34044
20	1.30103	70	1.84510	120	2.07918	170	2.23045	220	2.34242
21	1.32222	71	1.85126	121	2.08279	171	2.23300	221	2.34439
22	1.34242	72	1.85733	122	2.08636	172	2.23553	222	2.34635
23	1.36173	73	1.86332	123	2.08991	173	2.23805	223	2.34830
24	1.38021	74	1.86923	124	2.09342	174	2.24055	224	2.35025
25	1.39794	75	1.87506	125	2.09691	175	2.24304	225	2.35218
26	1.41497	76	1.88081	126	2.10037	176	2.24551	226	2.35411
27	1.43136	77	1.88649	127	2.10380	177	2.24797	227	2.35603
28	1.44716	78	1.89209	128	2.10721	178	2.25042	228	2.35793
29	1.46240	79	1.89763	129	2.11059	179	2.25285	229	2.35984
30	1.47712	80	1.90309	130	2.11394	180	2.25527	230	2.36173
31	1.49136	81	1.90849	131	2.11727	181	2.25768	231	2.36361
32	1.50515	82	1.91381	132	2.12057	182	2.26007	232	2.36549
33	1.51851	83	1.91908	133	2.12385	183	2.26245	233	2.36736
34	1.53148	84	1.92428	134	2.12710	184	2.26482	234	2.36922
35	1.54407	85	1.92942	135	2.13033	185	2.26717	235	2.37107
36	1.55630	86	1.93450	136	2.13354	186	2.26951	236	2.37291
37	1.56820	87	1.93952	137	2.13672	187	2.27184	237	2.37475
38	1.57973	88	1.94448	138	2.13988	188	2.27416	238	2.37658
39	1.59106	89	1.94939	139	2.14301	189	2.27646	239	2.37840
40	1.60206	90	1.95424	140	2.14613	190	2.27875	240	2.38021
41	1.61278	91	1.95904	141	2.14922	191	2.28103	241	2.38202
42	1.62325	92	1.96379	142	2.15229	192	2.28330	242	2.38382
43	1.63347	93	1.96848	143	2.15534	193	2.28556	243	2.38561
44	1.64345	94	1.97313	144	2.15836	194	2.28780	244	2.38739
45	1.65321	95	1.97772	145	2.16137	195	2.29003	245	2.38917
46	1.66276	96	1.98227	146	2.16435	196	2.29226	246	2.39094
47	1.67210	97	1.98677	147	2.16732	197	2.29447	247	2.39270
48	1.68124	98	1.99123	148	2.17026	198	2.29667	248	2.39445
49	1.69020	99	1.99564	149	2.17319	199	2.29885	249	2.39620
50	1.69897	100	2.00000	150	2.17609	200	2.30103	250	2.39794

Logarithms of Numbers

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1000-1500

No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	Prop. parts
100	00000	43	00043	44	00087	43	00130	43	00173	44	00217	43	00260	43	00303	43	00346	43	00389	43	44 43
101	00432	43	00475	43	00518	43	00561	43	00604	43	00647	42	00689	43	00732	43	00775	42	00817	43	1 4 4
102	00860	43	00903	42	00945	43	00988	42	01030	42	01072	43	01115	42	01157	42	01199	43	01242	42	2 9 9
103	01284	42	01326	42	01368	42	01410	42	01452	42	01494	42	01536	42	01578	42	01620	42	01662	41	3 13 13
104	01703	42	01745	42	01787	41	01828	42	01870	42	01912	41	01953	42	01995	41	02036	42	02078	41	4 18 17
105	02119	41	02160	42	02202	41	02243	41	02284	41	02325	41	02366	41	02407	42	02449	41	02490	41	5 22 22
106	02531	41	02572	40	02612	41	02653	41	02694	41	02735	41	02776	40	02816	41	02857	41	02898	40	6 26 26
107	02938	41	02979	40	03019	41	03060	40	03100	41	03141	40	03181	41	03222	40	03262	40	03302	40	7 31 30
108	03342	41	03383	40	03423	40	03463	40	03503	40	03543	40	03583	40	03623	40	03663	40	03703	40	8 35 34
109	03743	39	03782	40	03822	40	03862	40	03902	39	03941	40	03981	40	04021	39	04060	40	04100	39	9 40 39
110	04139	40	04179	39	04218	40	04258	39	04297	39	04336	40	04376	39	04415	39	04454	39	04493	39	42 41
111	04532	39	04571	39	04610	40	04650	39	04689	38	04727	39	04766	39	04805	39	04844	39	04883	39	1 4 4
112	04922	39	04961	38	04999	39	05038	39	05077	38	05115	39	05154	38	05192	39	05231	38	05269	39	2 8 8
113	05308	38	05346	39	05385	38	05423	38	05461	39	05500	38	05538	38	05576	38	05614	38	05652	38	3 13 12
114	05690	38	05729	38	05767	38	05805	38	05843	38	05881	37	05918	38	05956	38	05994	38	06032	38	4 17 16
115	06070	38	06108	37	06145	38	06183	38	06221	37	06258	38	06296	37	06333	38	06371	37	06408	38	5 21 20
116	06446	37	06483	38	06521	37	06558	37	06595	38	06633	37	06670	37	06707	37	06744	37	06781	38	6 25 25
117	06819	37	06856	37	06893	37	06930	37	06967	37	07004	37	07041	37	07078	37	07115	36	07151	37	7 29 29
118	07188	37	07225	37	07262	36	07298	37	07335	37	07372	36	07408	37	07445	37	07482	36	07518	37	8 34 33
119	07555	36	07591	37	07628	36	07664	36	07700	37	07737	36	07773	36	07809	37	07846	36	07882	36	9 38 37
120	07918	36	07954	36	07990	37	08027	36	08063	36	08099	36	08135	36	08171	36	08207	36	08243	36	40 39
121	08279	35	08314	36	08350	36	08386	36	08422	36	08458	35	08493	36	08529	36	08565	35	08600	36	1 4 4
122	08636	36	08672	35	08707	36	08743	35	08778	36	08814	35	08849	35	08884	36	08920	35	08955	36	2 8 8
123	08991	35	09026	35	09061	35	09096	36	09132	35	09167	35	09202	35	09237	35	09272	35	09307	35	3 12 12
124	09342	35	09377	35	09412	35	09447	35	09482	35	09517	35	09552	35	09587	34	09621	35	09656	35	4 16 16
125	09691	35	09726	34	09760	35	09795	35	09830	34	09864	35	09899	35	09934	34	09968	35	10003	34	5 20 20
126	10037	35	10072	34	10106	34	10140	35	10175	34	10209	34	10243	35	10278	34	10312	34	10346	34	6 24 23
127	10380	35	10415	34	10449	34	10483	34	10517	34	10551	34	10585	34	10619	34	10653	34	10687	34	7 28 27
128	10721	34	10755	34	10789	34	10823	34	10857	33	10890	34	10924	34	10958	34	10992	33	11025	34	8 32 31
129	11059	34	11093	33	11126	34	11160	33	11193	34	11227	34	11261	33	11294	33	11327	34	11361	33	9 36 35
130	11394	34	11428	33	11461	33	11494	34	11528	33	11561	33	11594	34	11628	33	11661	33	11694	33	38 37
131	11727	33	11760	33	11793	33	11826	34	11860	33	11893	33	11926	33	11959	33	11992	32	12024	33	1 4 4
132	12057	33	12090	33	12123	33	12156	33	12189	33	12222	32	12254	33	12287	33	12320	32	12352	33	2 8 7
133	12385	33	12418	32	12450	33	12483	33	12516	32	12548	33	12581	32	12613	33	12646	32	12678	32	3 11 11
134	12710	33	12743	32	12775	33	12808	32	12840	32	12872	33	12905	32	12937	32	12969	32	13001	32	4 15 15
135	13033	33	13066	32	13098	32	13130	32	13162	32	13194	32	13226	32	13258	32	13290	32	13322	32	5 19 18
136	13354	32	13386	32	13418	32	13450	31	13481	32	13513	32	13545	32	13577	32	13609	31	13640	32	6 23 22
137	13672	32	13704	31	13735	32	13767	32	13799	31	13830	32	13862	31	13893	32	13925	31	13956	32	7 27 26
138	13988	31	14019	32	14051	31	14082	32	14114	31	14145	31	14176	32	14208	31	14239	31	14270	31	8 30 30
139	14301	32	14333	31	14364	31	14395	31	14426	31	14457	32	14489	31	14520	31	14551	31	14582	31	9 34 33
140	14613	31	14644	31	14675	31	14706	31	14737	31	14768	31	14799	30	14829	31	14860	31	14891	31	36 35
141	14922	31	14953	30	14983	31	15014	31	15045	31	15076	30	15106	31	15137	31	15168	30	15198	31	1 4 4
142	15229	30	15259	31	15290	30	15320	31	15351	30	15381	31	15412	30	15442	31	15473	30	15503	31	2 7 7
143	15534	30	15564	30	15594	31	15625	30	15655	30	15685	30	15715	31	15746	30	15776	30	15806	30	3 11 10
144	15836	30	15866	31	15897	30	15927	30	15957	30	15987	30	16017	30	16047	30	16077	30	16107	30	4 14 14
145	16137	30	16167	30	16197	30	16227	29	16256	30	16286	30	16316	30	16346	30	16376	30	16406	29	5 18 18
146	16435	30	16465	30	16495	29	16524	30	16554	30	16584	29	16613	30	16643	30	16673	29	16702	30	6 22 21
147	16732	29	16761	30	16791	29	16820	30	16850	29	16879	30	16909	29	16938	29	16967	30	16997	29	7 25 24
148	17026	30	17056	29	17085	29	17114	29	17143	30	17173	29	17202	29	17231	29	17260	29	17289	30	8 29 28
149	17319	29	17348	29	17377	29	17406	29	17435	29	17464	29	17493	29	17522	29	17551	29	17580	29	9 32 32
150	17609	29	17638	29	17667	29	17696	29	17725	29	17754	28	17782	29	17811	29	17840	29	17869	29	34 33
No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	
																					1 3 3
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Logarithms of Numbers

1500-2000

No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	Prop. parts.
150	17609	29	17638	29	17667	29	17696	29	17725	29	17754	29	17782	29	17811	29	17840	29	17869	29	32 31
151	17898	28	17926	28	17955	28	17984	28	18013	28	18041	28	18070	28	18099	28	18127	28	18156	28	1 3 3
152	18184	28	18213	28	18241	28	18270	28	18298	28	18327	28	18355	28	18384	28	18412	28	18441	28	2 6 6
153	18469	28	18498	28	18526	28	18554	28	18583	28	18611	28	18639	28	18667	28	18696	28	18724	28	3 10 9
154	18752	28	18780	28	18808	28	18837	28	18865	28	18893	28	18921	28	18949	28	18977	28	19005	28	4 13 12
155	19033	28	19061	28	19089	28	19117	28	19145	28	19173	28	19201	28	19229	28	19257	28	19285	27	5 16 16
156	19312	28	19340	28	19368	28	19396	28	19424	27	19451	28	19479	28	19507	28	19535	27	19562	28	6 19 19
157	19590	28	19618	27	19645	28	19673	27	19700	28	19728	28	19756	27	19783	28	19811	27	19838	28	7 22 22
158	19866	27	19893	28	19921	27	19948	28	19976	27	20003	27	20030	28	20058	27	20085	27	20112	28	8 26 25
159	20140	27	20167	27	20194	28	20222	27	20249	27	20276	27	20303	27	20330	28	20358	27	20385	27	9 29 28
160	20412	27	20439	27	20466	27	20493	27	20520	28	20548	27	20575	27	20602	27	20629	27	20656	27	30 29
161	20683	27	20710	27	20737	28	20763	27	20790	27	20817	28	20844	27	20871	27	20898	27	20925	27	1 3 3
162	20952	26	20978	27	21005	27	21032	27	21059	28	21085	27	21112	27	21139	26	21165	27	21192	27	2 6 6
163	21219	26	21245	27	21272	27	21299	26	21325	27	21352	26	21378	27	21405	26	21431	27	21458	26	3 9 9
164	21484	27	21511	26	21537	27	21564	26	21590	27	21617	26	21643	26	21669	27	21696	26	21722	26	4 12 12
165	21748	27	21775	26	21801	26	21827	27	21854	26	21880	26	21906	27	21932	26	21958	27	21985	26	5 15 14
166	22011	26	22037	26	22063	26	22089	26	22115	26	22141	26	22167	27	22194	26	22220	26	22246	26	6 18 17
167	22272	26	22298	26	22324	26	22350	26	22376	25	22401	26	22427	26	22453	26	22479	26	22505	26	7 21 20
168	22531	26	22557	26	22583	25	22608	26	22634	26	22660	26	22686	26	22712	25	22737	26	22763	26	8 24 23
169	22789	25	22814	26	22840	26	22866	25	22891	26	22917	26	22943	25	22968	26	22994	25	23019	26	9 27 26
170	23045	25	23070	26	23096	25	23121	26	23147	25	23172	26	23198	25	23223	26	23249	25	23274	26	28 27
171	23300	25	23325	25	23350	26	23376	25	23401	25	23426	26	23452	25	23477	25	23502	26	23528	25	1 3 3
172	23553	25	23578	25	23603	26	23629	25	23654	25	23679	25	23704	25	23729	25	23754	25	23779	26	2 6 5
173	23805	25	23830	25	23855	25	23880	25	23905	25	23930	25	23955	25	23980	25	24005	25	24030	25	3 8 8
174	24055	25	24080	25	24105	25	24130	25	24155	25	24180	24	24204	25	24229	25	24254	25	24279	25	4 11 11
175	24304	25	24329	24	24353	25	24378	25	24403	25	24428	24	24452	25	24477	25	24502	25	24527	24	5 14 14
176	24551	25	24576	25	24601	24	24625	25	24650	24	24674	25	24699	25	24724	24	24748	25	24773	24	6 17 16
177	24797	25	24822	24	24846	25	24871	24	24895	25	24920	24	24944	25	24969	24	24993	25	25018	24	7 20 19
178	25042	24	25066	25	25091	24	25115	24	25139	25	25164	24	25188	24	25212	25	25237	24	25261	24	8 22 22
179	25285	25	25310	24	25334	24	25358	24	25382	24	25406	25	25431	24	25455	24	25479	24	25503	24	9 25 24
180	25527	24	25551	24	25575	25	25600	24	25624	24	25648	24	25672	24	25696	24	25720	24	25744	24	26 25
181	25768	24	25792	24	25816	24	25840	24	25864	24	25888	24	25912	23	25935	24	25959	24	25983	24	1 3 2
182	26007	24	26031	24	26055	24	26079	23	26102	24	26126	24	26150	24	26174	24	26198	23	26221	24	2 5 5
183	26245	24	26269	24	26293	23	26316	24	26340	24	26364	23	26387	24	26411	24	26435	23	26458	24	3 8 8
184	26482	23	26505	24	26529	24	26553	23	26576	24	26600	23	26623	24	26647	23	26670	24	26694	23	4 10 10
185	26717	24	26741	23	26764	24	26788	23	26811	23	26834	24	26858	23	26881	24	26905	23	26928	23	5 13 12
186	26951	24	26975	23	26998	23	27021	24	27045	23	27068	23	27091	23	27114	24	27138	23	27161	23	6 16 15
187	27184	23	27207	24	27231	23	27254	23	27277	23	27300	23	27323	23	27346	24	27370	23	27393	23	7 18 18
188	27416	23	27439	23	27462	23	27485	23	27508	23	27531	23	27554	23	27577	23	27600	23	27623	23	8 21 20
189	27646	23	27669	23	27692	23	27715	23	27738	23	27761	23	27784	23	27807	23	27830	22	27852	23	9 23 22
190	27875	23	27898	23	27921	23	27944	23	27967	22	27989	23	28012	23	28035	23	28058	23	28081	22	24 23
191	28103	23	28126	23	28149	22	28171	23	28194	23	28217	23	28240	23	28262	23	28285	23	28307	23	1 2 2
192	28330	23	28353	23	28375	23	28398	23	28421	22	28443	23	28466	23	28488	23	28511	23	28533	23	2 5 5
193	28556	22	28578	23	28601	22	28623	23	28646	22	28668	23	28691	22	28713	23	28735	23	28758	22	3 7 7
194	28780	22	28803	22	28825	22	28847	23	28870	22	28892	22	28914	23	28937	22	28959	22	28981	22	4 10 9
195	29003	22	29026	22	29048	22	29070	22	29092	23	29115	22	29137	22	29159	22	29181	22	29203	23	5 12 12
196	29226	22	29248	22	29270	22	29292	22	29314	22	29336	22	29358	22	29380	22	29403	22	29425	22	6 14 14
197	29447	22	29469	22	29491	22	29513	22	29535	22	29557	22	29579	22	29601	22	29623	22	29645	22	7 17 16
198	29667	21	29688	22	29710	22	29732	22	29754	22	29776	22	29798	22	29820	22	29842	21	29863	22	8 19 18
199	29885	22	29907	22	29929	22	29951	22	29973	21	29994	22	30016	22	30038	22	30060	21	30081	22	9 22 21
200	30103	22	30125	21	30146	22	30168	22	30190	21	30211	22	30233	22	30255	21	30276	22	30298	22	22 21
No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	
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Logarithms of Numbers

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2000-2500

No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	Prop. parts
200	30103	22	30125	21	30146	22	30168	22	30190	21	30211	22	30233	22	30255	21	30276	22	30298	22	22
201	30320	21	30341	22	30363	21	30384	22	30406	22	30428	21	30449	22	30471	21	30492	22	30514	21	1
202	30535	22	30557	21	30578	22	30600	21	30621	22	30643	21	30664	22	30685	22	30707	21	30728	22	2
203	30750	21	30771	21	30792	22	30814	21	30835	21	30856	22	30878	21	30899	21	30920	22	30942	21	3
204	30963	21	30984	22	31006	21	31027	21	31048	21	31069	22	31091	21	31112	21	31133	21	31154	21	4
205	31175	22	31197	21	31218	21	31239	21	31260	21	31281	21	31302	21	31323	22	31345	21	31366	21	5
206	31387	21	31408	21	31429	21	31450	21	31471	21	31492	21	31513	21	31534	21	31555	21	31576	21	6
207	31597	21	31618	21	31639	21	31660	21	31681	21	31702	21	31723	21	31744	21	31765	21	31785	21	7
208	31806	21	31827	21	31848	21	31869	21	31890	21	31911	20	31931	21	31952	21	31973	21	31994	21	8
209	32015	20	32035	21	32056	21	32077	21	32098	20	32118	21	32139	21	32160	21	32181	20	32201	21	9
210	32222	21	32243	20	32263	21	32284	21	32305	20	32325	21	32346	21	32366	21	32387	21	32408	20	21
211	32428	21	32449	20	32469	21	32490	20	32510	21	32531	21	32552	20	32572	21	32593	20	32613	21	1
212	32634	20	32654	21	32675	20	32695	20	32715	21	32736	20	32756	21	32777	20	32797	21	32818	20	2
213	32838	20	32858	20	32879	20	32899	20	32919	21	32940	20	32960	20	32980	21	33001	20	33021	20	3
214	33041	21	33062	20	33082	20	33102	20	33122	21	33143	20	33163	20	33183	20	33203	21	33224	20	4
215	33244	20	33264	20	33284	20	33304	21	33325	20	33345	20	33365	20	33385	20	33405	20	33425	20	5
216	33445	20	33465	21	33486	20	33506	20	33526	20	33546	20	33566	20	33586	20	33606	20	33626	20	6
217	33646	20	33666	20	33686	20	33706	20	33726	20	33746	20	33766	20	33786	20	33806	20	33826	20	7
218	33846	20	33866	19	33885	20	33905	20	33925	20	33945	20	33965	20	33985	20	34005	20	34025	19	8
219	34044	20	34064	20	34084	20	34104	20	34124	19	34143	20	34163	20	34183	20	34203	20	34223	19	9
220	34242	20	34262	20	34282	19	34301	20	34321	20	34341	20	34361	19	34380	20	34400	20	34420	19	1
221	34439	20	34459	20	34479	19	34498	20	34518	19	34537	20	34557	19	34577	19	34596	20	34616	19	2
222	34635	20	34655	19	34674	20	34694	19	34713	20	34733	20	34753	19	34772	20	34792	19	34811	19	3
223	34830	20	34850	19	34869	20	34889	19	34908	20	34928	19	34947	20	34967	19	34986	19	35005	20	4
224	35025	19	35044	20	35064	19	35083	19	35102	20	35122	19	35141	19	35160	20	35180	19	35199	19	5
225	35218	20	35238	19	35257	19	35276	19	35295	20	35315	19	35334	19	35353	19	35372	20	35392	19	6
226	35411	19	35430	19	35449	19	35468	20	35488	19	35507	19	35526	19	35545	19	35564	19	35583	20	7
227	35603	19	35622	19	35641	19	35660	19	35679	19	35698	19	35717	19	35736	19	35755	19	35774	20	8
228	35793	20	35813	19	35832	19	35851	19	35870	19	35889	19	35908	19	35927	19	35946	19	35965	19	9
229	35984	19	36003	18	36021	19	36040	19	36059	19	36078	19	36097	19	36116	19	36135	19	36154	19	1
230	36173	19	36192	19	36211	18	36229	19	36248	19	36267	19	36286	19	36305	19	36324	18	36342	19	2
231	36361	19	36380	19	36399	19	36418	18	36436	19	36455	19	36474	19	36493	18	36511	19	36530	19	3
232	36549	19	36568	18	36586	19	36605	19	36624	18	36642	19	36661	19	36680	18	36698	19	36717	19	4
233	36736	18	36754	19	36773	18	36791	19	36810	19	36829	18	36847	19	36866	18	36884	19	36903	19	5
234	36922	18	36940	19	36959	18	36977	19	36996	18	37014	19	37033	18	37051	19	37070	18	37088	19	6
235	37107	18	37125	19	37144	18	37162	19	37181	18	37199	19	37218	18	37236	19	37254	19	37273	18	7
236	37291	19	37310	18	37328	18	37346	19	37365	18	37383	18	37401	19	37420	18	37438	19	37457	18	8
237	37475	18	37493	18	37511	19	37530	18	37548	18	37566	19	37585	18	37603	18	37621	18	37639	19	9
238	37658	18	37676	18	37694	18	37712	19	37731	18	37749	18	37767	18	37785	18	37803	19	37822	18	1
239	37840	18	37858	18	37876	18	37894	18	37912	19	37931	18	37949	18	37967	18	37985	18	38003	18	2
240	38021	18	38039	18	38057	18	38075	18	38093	19	38112	18	38130	18	38148	18	38166	18	38184	18	3
241	38202	18	38220	18	38238	18	38256	18	38274	18	38292	18	38310	18	38328	18	38346	18	38364	18	4
242	38382	17	38399	18	38417	18	38435	18	38453	18	38471	18	38489	18	38507	18	38525	18	38543	18	5
243	38561	17	38578	18	38596	18	38614	18	38632	18	38650	18	38668	18	38686	17	38703	18	38721	18	6
244	38739	18	38757	18	38775	17	38792	18	38810	18	38828	18	38846	17	38863	18	38881	18	38899	18	7
245	38917	17	38934	18	38952	18	38970	17	38987	18	39005	18	39023	18	39041	17	39058	18	39076	18	8
246	39094	17	39111	18	39129	17	39146	18	39164	18	39182	17	39199	18	39217	18	39235	17	39252	18	9
247	39270	17	39287	18	39305	17	39322	18	39340	18	39358	17	39375	18	39393	17	39410	18	39428	17	1
248	39445	18	39463	17	39480	18	39498	17	39515	18	39533	17	39550	18	39568	17	39585	17	39602	18	2
249	39620	17	39637	18	39655	17	39672	18	39690	17	39707	17	39724	18	39742	17	39759	18	39777	17	3
250	39794	17	39811	18	39829	17	39846	17	39863	18	39881	17	39898	17	39915	18	39933	17	39950	17	4
No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	5
																					10
																					11
																					12
																					13
																					14
																					15

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Logarithms of Numbers

2500-3000

No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	Prop. parts
250	39794	17	39811	18	39829	17	39846	17	39863	18	39881	17	39898	17	39915	18	39933	17	39950	17	18
251	39967	18	39985	17	40002	17	40019	18	40037	17	40054	17	40071	17	40088	18	40106	17	40123	17	1
252	40140	17	40157	18	40175	17	40192	17	40209	17	40226	17	40243	18	40261	17	40278	17	40295	17	2
253	40312	17	40329	17	40346	18	40364	17	40381	17	40398	17	40415	17	40432	17	40449	17	40466	17	3
254	40483	17	40500	18	40518	17	40535	17	40552	17	40569	17	40586	17	40603	17	40620	17	40637	17	4
255	40654	17	40671	17	40688	17	40705	17	40722	17	40739	17	40756	17	40773	17	40790	17	40807	17	5
256	40824	17	40841	17	40858	17	40875	17	40892	17	40909	17	40926	17	40943	17	40960	18	40976	17	6
257	40993	17	41010	17	41027	17	41044	17	41061	17	41078	17	41095	16	41111	17	41128	17	41145	17	7
258	41162	17	41179	17	41196	16	41212	17	41229	17	41246	17	41263	17	41280	16	41296	17	41313	17	8
259	41330	17	41347	16	41363	17	41380	17	41397	17	41414	16	41430	17	41447	17	41464	17	41481	16	9
260	41497	17	41514	17	41531	16	41547	17	41564	17	41581	16	41597	17	41614	17	41631	16	41647	17	17
261	41664	17	41681	16	41697	17	41714	17	41731	16	41747	17	41764	16	41780	17	41797	17	41814	16	1
262	41830	17	41847	16	41863	17	41880	16	41896	17	41913	16	41929	17	41946	17	41963	16	41979	17	2
263	41996	16	42012	17	42029	16	42045	17	42062	16	42078	17	42095	16	42111	16	42127	17	42144	16	3
264	42160	17	42177	16	42193	17	42210	16	42226	17	42243	16	42259	16	42275	17	42292	16	42308	17	4
265	42325	16	42341	16	42357	17	42374	16	42390	16	42406	17	42423	16	42439	16	42455	17	42472	16	5
266	42488	16	42504	17	42521	16	42537	16	42553	17	42570	16	42586	16	42602	17	42619	16	42635	16	6
267	42651	16	42667	17	42684	16	42700	16	42716	16	42732	17	42749	16	42765	16	42781	16	42797	16	7
268	42813	17	42830	16	42846	16	42862	16	42878	16	42894	17	42911	16	42927	16	42943	17	42959	16	8
269	42975	16	42991	17	43008	16	43024	16	43040	16	43056	16	43072	16	43088	16	43104	16	43120	16	9
270	43136	16	43152	17	43169	16	43185	16	43201	16	43217	16	43233	16	43249	16	43265	16	43281	16	16
271	43297	16	43313	16	43329	16	43345	16	43361	16	43377	16	43393	16	43409	16	43425	16	43441	16	1
272	43457	16	43473	16	43489	16	43505	16	43521	16	43537	16	43553	16	43569	15	43584	16	43600	16	2
273	43616	16	43632	16	43648	16	43664	16	43680	16	43696	16	43712	15	43727	16	43743	16	43759	16	3
274	43775	16	43791	16	43807	16	43823	15	43838	16	43854	16	43870	16	43886	16	43902	15	43917	16	4
275	43933	16	43949	16	43965	16	43981	15	43996	16	44012	16	44028	16	44044	15	44059	16	44075	16	5
276	44091	16	44107	15	44122	16	44138	16	44154	16	44170	15	44185	16	44201	16	44217	15	44232	16	6
277	44248	16	44264	15	44279	16	44295	16	44311	15	44326	16	44342	16	44358	15	44373	16	44389	15	7
278	44404	16	44420	16	44436	15	44451	16	44467	16	44483	15	44498	16	44514	15	44529	16	44545	15	8
279	44560	16	44576	16	44592	15	44607	16	44623	15	44638	16	44654	15	44669	16	44685	15	44700	16	9
280	44716	15	44731	16	44747	15	44762	16	44778	15	44793	16	44809	15	44824	16	44840	15	44855	16	15
281	44871	15	44886	16	44902	15	44917	16	44932	16	44948	15	44963	16	44979	15	44994	16	45010	15	1
282	45025	15	45040	16	45056	15	45071	15	45086	16	45102	15	45117	16	45133	15	45148	15	45163	16	2
283	45179	15	45194	15	45209	16	45225	15	45240	15	45255	16	45271	15	45286	15	45301	16	45317	15	3
284	45332	15	45347	15	45362	16	45378	15	45393	15	45408	15	45423	16	45439	15	45454	15	45469	15	4
285	45484	16	45500	15	45515	15	45530	15	45545	16	45561	15	45576	15	45591	15	45606	15	45621	16	5
286	45637	15	45652	15	45667	15	45682	15	45697	15	45712	16	45728	15	45743	15	45758	15	45773	15	6
287	45788	15	45803	15	45818	16	45834	15	45849	15	45864	15	45879	15	45894	15	45909	15	45924	15	7
288	45939	15	45954	15	45969	15	45984	16	46000	15	46015	15	46030	15	46045	15	46060	15	46075	15	8
289	46090	15	46105	15	46120	15	46135	15	46150	15	46165	15	46180	15	46195	15	46210	15	46225	15	9
290	46240	15	46255	15	46270	15	46285	15	46300	15	46315	15	46330	15	46345	14	46359	15	46374	15	14
291	46389	15	46404	15	46419	15	46434	15	46449	15	46464	15	46479	15	46494	15	46509	14	46523	15	1
292	46538	15	46553	15	46568	15	46583	15	46598	15	46613	14	46627	15	46642	15	46657	15	46672	15	2
293	46687	15	46702	14	46716	15	46731	15	46746	15	46761	15	46776	14	46790	15	46805	15	46820	15	3
294	46835	15	46850	14	46864	15	46879	15	46894	15	46909	14	46923	15	46938	15	46953	14	46967	15	4
295	46982	15	46997	15	47012	14	47026	15	47041	15	47056	14	47070	15	47085	15	47100	14	47114	15	5
296	47129	15	47144	15	47159	14	47173	15	47188	14	47202	15	47217	15	47232	14	47246	15	47261	15	6
297	47276	14	47290	15	47305	14	47319	15	47334	15	47349	14	47363	15	47378	14	47392	15	47407	15	7
298	47422	14	47436	15	47451	14	47465	15	47480	14	47494	15	47509	15	47524	14	47538	15	47553	14	8
299	47567	15	47582	14	47596	15	47611	14	47625	15	47640	14	47654	15	47669	14	47683	15	47698	14	9
300	47712	15	47727	14	47741	15	47756	14	47770	14	47784	15	47799	14	47813	15	47828	14	47842	15	10
No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	

Logarithms of Numbers

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3000-3500

No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	Prop. parts
300	47712	15	47727	14	47741	13	47756	14	47770	14	47784	15	47799	14	47813	15	47828	14	47842	15	
301	47857	14	47871	14	47885	13	47900	14	47914	15	47929	14	47943	15	47958	14	47972	14	47986	15	15
302	48001	14	48015	14	48029	13	48044	14	48058	15	48073	14	48087	14	48101	15	48116	14	48130	14	
303	48144	15	48159	14	48173	14	48187	15	48202	14	48216	14	48230	14	48244	15	48259	14	48273	14	1
304	48287	15	48302	14	48316	14	48330	14	48344	15	48359	14	48373	14	48387	14	48401	15	48416	14	2
																					3
305	48430	14	48444	14	48458	13	48473	14	48487	14	48501	15	48515	15	48530	14	48544	14	48558	14	4
306	48572	14	48586	13	48601	14	48615	14	48629	14	48643	14	48657	14	48671	15	48686	14	48700	14	5
307	48714	14	48728	14	48742	14	48756	14	48770	15	48785	14	48799	14	48813	14	48827	14	48841	14	6
308	48855	14	48869	14	48883	14	48897	14	48911	15	48926	14	48940	14	48954	14	48968	14	48982	14	7
309	48996	14	49010	14	49024	14	49038	14	49052	14	49066	14	49080	14	49094	14	49108	14	49122	14	8
																					9
310	49136	14	49150	14	49164	14	49178	14	49192	14	49206	14	49220	14	49234	14	49248	14	49262	14	
311	49276	14	49290	14	49304	14	49318	14	49332	14	49346	14	49360	14	49374	14	49388	14	49402	13	
312	49415	14	49429	14	49443	14	49457	14	49471	14	49485	14	49499	14	49513	14	49527	14	49541	13	
313	49554	14	49568	14	49582	14	49596	14	49610	14	49624	14	49638	13	49651	14	49665	14	49679	14	
314	49693	14	49707	14	49721	13	49734	14	49748	14	49762	14	49776	14	49790	13	49803	14	49817	14	
																					14
315	49831	14	49845	14	49859	13	49872	14	49886	14	49900	14	49914	13	49927	14	49941	14	49955	14	
316	49969	13	49982	14	49996	14	50010	14	50024	13	50037	14	50051	14	50065	14	50079	13	50092	14	1
317	50106	14	50120	13	50133	14	50147	14	50161	13	50174	14	50188	14	50202	13	50215	14	50229	14	2
318	50243	13	50256	14	50270	14	50284	13	50297	14	50311	14	50325	13	50338	14	50352	13	50365	14	3
319	50379	14	50393	13	50406	14	50420	13	50433	14	50447	14	50461	13	50474	14	50488	13	50501	14	4
																					5
320	50515	14	50529	13	50542	14	50556	13	50569	14	50583	13	50596	14	50610	13	50623	14	50637	14	6
321	50651	13	50664	14	50678	13	50691	14	50705	13	50718	14	50732	13	50745	14	50759	13	50772	14	7
322	50786	13	50799	14	50813	13	50826	14	50840	13	50853	13	50866	14	50880	13	50893	14	50907	13	8
323	50920	14	50934	13	50947	14	50961	13	50974	13	50987	14	51001	13	51014	14	51028	13	51041	14	9
324	51055	13	51068	13	51081	14	51095	13	51108	13	51121	14	51135	13	51148	14	51162	13	51175	13	
325	51188	14	51202	13	51215	13	51228	14	51242	13	51255	13	51268	14	51282	13	51295	13	51308	14	
326	51322	13	51335	13	51348	14	51362	13	51375	13	51388	14	51402	13	51415	13	51428	13	51441	14	
327	51455	13	51468	13	51481	14	51495	13	51508	13	51521	13	51534	14	51548	13	51561	13	51574	13	
328	51587	14	51601	13	51614	13	51627	13	51640	14	51654	13	51667	13	51680	13	51693	13	51706	14	
329	51720	13	51733	13	51746	13	51759	13	51772	14	51786	13	51799	13	51812	13	51825	13	51838	13	
																					13
330	51851	14	51865	13	51878	13	51891	13	51904	13	51917	13	51930	13	51943	14	51957	13	51970	13	1
331	51983	13	51996	13	52009	13	52022	13	52035	13	52048	13	52061	14	52075	13	52088	13	52101	13	2
332	52114	13	52127	13	52140	13	52153	13	52166	13	52179	13	52192	13	52205	13	52218	13	52231	13	3
333	52244	13	52257	13	52270	14	52284	13	52297	13	52310	13	52323	13	52336	13	52349	13	52362	13	4
334	52375	13	52388	13	52401	13	52414	13	52427	13	52440	13	52453	13	52466	13	52479	13	52492	12	5
																					6
335	52504	13	52517	13	52530	13	52543	13	52556	13	52569	13	52582	13	52595	13	52608	13	52621	13	7
336	52634	13	52647	13	52660	13	52673	13	52686	13	52699	12	52711	13	52724	13	52737	13	52750	13	8
337	52763	13	52776	13	52789	13	52802	13	52815	12	52827	13	52840	13	52853	13	52866	13	52879	13	9
338	52892	13	52905	12	52917	13	52930	13	52943	13	52956	13	52969	13	52982	12	52994	13	53007	13	
339	53020	13	53033	13	53046	12	53058	13	53071	13	53084	13	53097	13	53110	12	53122	13	53135	13	
340	53148	13	53161	12	53173	13	53186	13	53199	13	53212	12	53224	13	53237	13	53250	13	53263	12	
341	53275	13	53288	13	53301	13	53314	12	53326	13	53339	13	53352	12	53364	13	53377	13	53390	13	
342	53403	12	53415	13	53428	13	53441	12	53453	13	53466	13	53479	12	53491	13	53504	13	53517	12	
343	53529	13	53542	13	53555	12	53567	13	53580	13	53593	12	53605	13	53618	13	53631	12	53643	13	
344	53656	12	53668	13	53681	13	53694	12	53706	13	53719	13	53732	12	53744	13	53757	12	53769	13	
																					12
345	53782	12	53794	13	53807	13	53820	12	53832	13	53845	12	53857	13	53870	12	53882	13	53895	13	
346	53908	12	53920	13	53933	12	53945	13	53958	12	53970	13	53983	12	53995	13	54008	12	54020	13	
347	54033	12	54045	13	54058	12	54070	13	54083	12	54095	13	54108	12	54120	13	54133	12	54145	13	
348	54158	12	54170	13	54183	12	54195	13	54208	12	54220	13	54233	12	54245	13	54258	12	54270	13	
349	54283	12	54295	12	54307	13	54320	12	54332	13	54345	12	54357	13	54370	12	54382	12	54394	13	
350	54407	12	54419	13	54432	12	54444	12	54456	13	54469	12	54481	13	54494	12	54506	12	54518	13	
No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	

No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d
350	54407	12	54419	13	54432	12	54444	12	54456	13	54469	12	54481	13	54494	12	54506	12	54518	13
351	54531	12	54543	12	54555	13	54568	12	54580	13	54593	12	54605	12	54617	13	54630	12	54642	12
352	54654	13	54667	12	54679	12	54691	13	54704	12	54716	12	54728	13	54741	12	54753	12	54765	12
353	54777	13	54790	12	54802	12	54814	13	54827	12	54839	12	54851	13	54864	12	54876	12	54888	12
354	54900	13	54913	12	54925	12	54937	12	54949	13	54962	12	54974	12	54986	12	54998	13	55011	12
355	55023	12	55035	12	55047	13	55060	12	55072	12	55084	12	55096	12	55108	13	55121	12	55133	12
356	55145	12	55157	12	55169	13	55182	12	55194	12	55206	12	55218	12	55230	12	55242	13	55255	12
357	55267	12	55279	12	55291	12	55303	12	55315	13	55328	12	55340	12	55352	12	55364	12	55376	12
358	55388	12	55400	13	55413	12	55425	12	55437	12	55449	12	55461	12	55473	12	55485	12	55497	12
359	55509	13	55522	12	55534	12	55546	12	55558	12	55570	12	55582	12	55594	12	55606	12	55618	12
360	55630	12	55642	12	55654	12	55666	12	55678	13	55691	12	55703	12	55715	12	55727	12	55739	12
361	55751	12	55763	12	55775	12	55787	12	55799	12	55811	12	55823	12	55835	12	55847	12	55859	12
362	55871	12	55883	12	55895	12	55907	12	55919	12	55931	12	55943	12	55955	12	55967	12	55979	12
363	55991	12	56003	12	56015	12	56027	11	56038	12	56050	12	56062	12	56074	12	56086	12	56098	12
364	56110	12	56122	12	56134	12	56146	12	56158	12	56170	12	56182	12	56194	11	56205	12	56217	12
365	56229	12	56241	12	56253	12	56265	12	56277	12	56289	12	56301	11	56312	12	56324	12	56336	12
366	56348	12	56360	12	56372	12	56384	12	56396	11	56407	12	56419	12	56431	12	56443	12	56455	12
367	56467	11	56478	12	56490	12	56502	12	56514	12	56526	12	56538	11	56549	12	56561	12	56573	12
368	56585	12	56597	11	56608	12	56620	12	56632	12	56644	12	56656	11	56667	12	56679	12	56691	12
369	56703	11	56714	12	56726	12	56738	12	56750	11	56761	12	56773	12	56785	12	56797	11	56808	12
370	56820	12	56832	12	56844	11	56855	12	56867	12	56879	12	56891	11	56902	12	56914	12	56926	11
371	56937	12	56949	12	56961	11	56972	12	56984	12	56996	12	57008	11	57019	12	57031	12	57043	11
372	57054	12	57066	12	57078	11	57089	12	57101	12	57113	11	57124	12	57136	12	57148	11	57159	12
373	57171	12	57183	11	57194	12	57206	11	57217	12	57229	12	57241	11	57252	12	57264	12	57276	11
374	57287	12	57299	11	57310	12	57322	12	57334	11	57345	12	57357	11	57368	12	57380	12	57392	11
375	57403	12	57415	11	57426	12	57438	11	57449	12	57461	12	57473	11	57484	12	57496	11	57507	12
376	57519	11	57530	12	57542	11	57553	12	57565	11	57576	12	57588	12	57600	11	57611	12	57623	11
377	57634	12	57646	11	57657	12	57669	11	57680	12	57692	11	57703	12	57715	11	57726	12	57738	11
378	57749	12	57761	11	57772	12	57784	11	57795	12	57807	11	57818	12	57830	11	57841	11	57852	12
379	57864	11	57875	12	57887	11	57898	12	57910	11	57921	12	57933	11	57944	11	57955	12	57967	11
380	57978	12	57990	11	58001	12	58013	11	58024	11	58035	12	58047	11	58058	12	58070	11	58081	11
381	58092	12	58104	11	58115	12	58127	11	58138	11	58149	12	58161	11	58172	12	58184	11	58195	11
382	58206	12	58218	11	58229	11	58240	12	58252	11	58263	11	58274	12	58286	11	58297	12	58309	11
383	58320	11	58331	12	58343	11	58354	11	58365	12	58377	11	58388	11	58399	11	58410	12	58422	11
384	58433	11	58444	12	58456	11	58467	11	58478	12	58490	11	58501	11	58512	12	58524	11	58535	11
385	58546	11	58557	12	58569	11	58580	11	58591	11	58602	12	58614	11	58625	11	58636	11	58647	12
386	58659	11	58670	11	58681	11	58692	12	58704	11	58715	11	58726	11	58737	12	58749	11	58760	11
387	58771	11	58782	12	58794	11	58805	11	58816	11	58827	11	58838	12	58850	11	58861	11	58872	11
388	58883	11	58894	12	58906	11	58917	11	58928	11	58939	11	58950	11	58961	12	58973	11	58984	11
389	58995	11	59006	11	59017	11	59028	12	59040	11	59051	11	59062	11	59073	11	59084	11	59095	11
390	59106	12	59118	11	59129	11	59140	11	59151	11	59162	11	59173	11	59184	11	59195	12	59207	11
391	59218	11	59229	11	59240	11	59251	11	59262	11	59273	11	59284	11	59295	11	59306	12	59318	11
392	59329	11	59340	11	59351	11	59362	11	59373	11	59384	11	59395	11	59406	11	59417	11	59428	11
393	59439	11	59450	11	59461	11	59472	11	59483	11	59494	12	59506	11	59517	11	59528	11	59539	11
394	59550	11	59561	11	59572	11	59583	11	59594	11	59605	11	59616	11	59627	11	59638	11	59649	11
395	59660	11	59671	11	59682	11	59693	11	59704	11	59715	11	59726	11	59737	11	59748	11	59759	11
396	59770	10	59780	11	59791	11	59802	11	59813	11	59824	11	59835	11	59846	11	59857	11	59868	11
397	59879	11	59890	11	59901	11	59912	11	59923	11	59934	11	59945	11	59956	10	59966	11	59977	11
398	59988	11	59999	11	60010	11	60021	11	60032	11	60043	11	60054	11	60065	11	60076	10	60086	11
399	60097	11	60108	11	60119	11	60130	11	60141	11	60152	11	60163	10	60173	11	60184	11	60195	11
400	60206	11	60217	11	60228	11	60239	10	60249	11	60260	11	60271	11	60282	11	60293	11	60304	10
No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d

4000-4500

No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	Prop. parts
400	60206	11	60217	11	60228	11	60239	11	60249	11	60260	11	60271	11	60282	11	60293	11	60304	10	11
401	60314	11	60325	11	60336	11	60347	11	60358	11	60369	10	60379	11	60390	11	60401	11	60412	11	
402	60423	10	60433	11	60444	11	60455	11	60466	11	60477	10	60487	11	60498	11	60509	11	60520	11	
403	60531	10	60541	11	60552	11	60563	11	60574	10	60584	11	60595	11	60606	11	60617	10	60627	11	
404	60638	11	60649	11	60660	10	60670	11	60681	11	60692	11	60703	10	60713	11	60724	11	60735	11	
405	60746	10	60756	11	60767	11	60778	10	60788	11	60799	11	60810	11	60821	10	60831	11	60842	11	
406	60853	10	60863	11	60874	11	60885	10	60895	11	60906	11	60917	10	60927	11	60938	11	60949	10	
407	60959	11	60970	11	60981	10	60991	11	61002	11	61013	10	61023	11	61034	11	61045	10	61055	11	
408	61066	11	61077	10	61087	11	61098	11	61109	10	61119	11	61130	10	61140	11	61151	11	61162	10	
409	61172	11	61183	11	61194	10	61204	11	61215	10	61225	11	61236	11	61247	10	61257	11	61268	10	
410	61278	11	61289	11	61300	10	61310	11	61321	10	61331	11	61342	10	61352	11	61363	11	61374	10	10
411	61384	11	61395	10	61405	11	61416	10	61426	11	61437	11	61448	10	61458	11	61469	10	61479	11	
412	61490	10	61500	11	61511	10	61521	11	61532	10	61542	11	61553	10	61563	11	61574	10	61584	11	
413	61595	11	61606	10	61616	11	61627	10	61637	11	61648	10	61658	11	61669	10	61679	11	61690	10	
414	61700	11	61711	10	61721	10	61731	11	61742	10	61752	11	61763	10	61773	11	61784	10	61794	11	
415	61805	10	61815	11	61826	10	61836	11	61847	10	61857	11	61868	10	61878	10	61888	11	61899	10	
416	61909	11	61920	10	61930	11	61941	10	61951	11	61962	10	61972	10	61982	11	61993	10	62003	11	
417	62014	10	62024	10	62034	11	62045	10	62055	11	62066	10	62076	10	62086	11	62097	10	62107	11	
418	62118	10	62128	10	62138	11	62149	10	62159	11	62170	10	62180	10	62190	11	62201	10	62211	10	
419	62221	11	62232	10	62242	10	62252	11	62263	10	62273	11	62284	10	62294	10	62304	11	62315	10	
420	62325	10	62335	11	62346	10	62356	10	62366	11	62377	10	62387	10	62397	11	62408	10	62418	10	9
421	62428	11	62439	10	62449	10	62459	10	62469	11	62480	10	62490	10	62500	11	62511	10	62521	10	
422	62531	11	62542	10	62552	10	62562	10	62572	11	62583	10	62593	10	62603	10	62613	11	62624	10	
423	62634	10	62644	11	62655	10	62665	10	62675	10	62685	11	62696	10	62706	10	62716	10	62726	11	
424	62737	10	62747	10	62757	10	62767	11	62778	10	62788	10	62798	10	62808	10	62818	11	62829	10	
425	62839	10	62849	10	62859	11	62870	10	62880	10	62890	10	62900	10	62910	11	62921	10	62931	10	
426	62941	10	62951	10	62961	11	62972	10	62982	10	62992	10	63002	10	63012	10	63022	11	63033	10	
427	63043	10	63053	10	63063	10	63073	10	63083	11	63094	10	63104	10	63114	10	63124	10	63134	10	
428	63144	11	63155	10	63165	10	63175	10	63185	10	63195	10	63205	10	63215	10	63225	11	63236	10	
429	63246	10	63256	10	63266	10	63276	10	63286	10	63296	10	63306	11	63317	10	63327	10	63337	10	
430	63347	10	63357	10	63367	10	63377	10	63387	10	63397	10	63407	10	63417	11	63428	10	63438	10	9
431	63448	10	63458	10	63468	10	63478	10	63488	10	63498	10	63508	10	63518	10	63528	10	63538	10	
432	63548	10	63558	10	63568	11	63579	10	63589	10	63599	10	63609	10	63619	10	63629	10	63639	10	
433	63649	10	63659	10	63669	10	63679	10	63689	10	63699	10	63709	10	63719	10	63729	10	63739	10	
434	63749	10	63759	10	63769	10	63779	10	63789	10	63799	10	63809	10	63819	10	63829	10	63839	10	
435	63849	10	63859	10	63869	10	63879	10	63889	10	63899	10	63909	10	63919	10	63929	10	63939	10	
436	63949	10	63959	10	63969	10	63979	9	63988	10	63998	10	64008	10	64018	10	64028	10	64038	10	
437	64048	10	64058	10	64068	10	64078	10	64088	10	64098	10	64108	10	64118	10	64128	9	64137	10	
438	64147	10	64157	10	64167	10	64177	10	64187	10	64197	10	64207	10	64217	10	64227	10	64237	9	
439	64246	10	64256	10	64266	10	64276	10	64286	10	64296	10	64306	10	64316	10	64326	9	64335	10	
440	64345	10	64355	10	64365	10	64375	10	64385	10	64395	9	64404	10	64414	10	64424	10	64434	10	8
441	64444	10	64454	10	64464	9	64473	10	64483	10	64493	10	64503	10	64513	10	64523	9	64532	10	
442	64542	10	64552	10	64562	10	64572	10	64582	9	64591	10	64601	10	64611	10	64621	10	64631	9	
443	64640	10	64650	10	64660	10	64670	10	64680	9	64689	10	64699	10	64709	10	64719	10	64729	9	
444	64738	10	64748	10	64758	10	64768	9	64777	10	64787	10	64797	10	64807	9	64816	10	64826	10	
445	64836	10	64846	10	64856	9	64865	10	64875	10	64885	10	64895	9	64904	10	64914	10	64924	9	
446	64933	10	64943	10	64953	10	64963	9	64972	10	64982	10	64992	10	65002	9	65011	10	65021	10	
447	65031	9	65040	10	65050	10	65060	10	65070	9	65079	10	65089	10	65099	9	65108	10	65118	10	
448	65128	9	65137	10	65147	10	65157	10	65167	9	65176	10	65186	10	65196	9	65205	10	65215	10	
449	65225	9	65234	10	65244	10	65254	9	65263	10	65273	10	65283	9	65292	10	65302	10	65312	9	
450	65321	10	65331	10	65341	9	65350	10	65360	9	65369	10	65379	10	65389	9	65398	10	65408	10	
No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	

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Logarithms of Numbers

4500-5000

No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	Prop. parts
450	65321	10	65331	10	65341	9	65350	10	65360	9	65369	10	65379	10	65389	9	65398	10	65408	10	10 1 2 3 4 5 6 7 8 9
451	65418	9	65427	10	65437	10	65447	9	65456	10	65466	9	65475	10	65485	10	65495	9	65504	10	
452	65514	9	65523	10	65533	10	65543	9	65552	10	65562	9	65571	10	65581	10	65591	9	65600	10	
453	65610	9	65619	10	65629	10	65639	9	65648	10	65658	9	65667	10	65677	9	65686	10	65696	10	
454	65706	9	65715	10	65725	9	65734	10	65744	9	65753	10	65763	9	65772	10	65782	10	65792	9	
455	65801	10	65811	9	65820	10	65830	9	65839	10	65849	9	65858	10	65868	9	65877	10	65887	9	9 1 2 3 4 5 6 7 8 9
456	65896	10	65906	10	65916	9	65925	10	65935	9	65944	10	65954	9	65963	10	65973	9	65982	10	
457	65992	9	66001	10	66011	9	66020	10	66030	9	66039	10	66049	9	66058	10	66068	9	66077	10	
458	66087	9	66096	10	66106	9	66115	10	66124	9	66134	10	66143	9	66153	10	66162	9	66172	10	
459	66181	10	66191	9	66200	10	66210	9	66219	10	66229	9	66238	10	66247	9	66257	10	66266	9	
460	66276	9	66285	10	66295	9	66304	10	66314	9	66323	10	66332	9	66342	10	66351	9	66361	10	8 1 2 3 4 5 6 7 8
461	66370	10	66380	9	66389	10	66398	9	66408	10	66417	9	66427	10	66436	9	66445	10	66455	9	
462	66464	10	66474	9	66483	10	66492	9	66502	10	66511	9	66521	10	66530	9	66539	10	66549	9	
463	66558	9	66567	10	66577	9	66586	10	66596	9	66605	10	66614	9	66624	10	66633	9	66642	10	
464	66652	9	66661	10	66671	9	66680	10	66689	9	66699	10	66708	9	66717	10	66727	9	66736	10	
465	66745	10	66755	9	66764	10	66773	9	66783	10	66792	9	66801	10	66811	9	66820	10	66829	9	7 1 2 3 4 5 6 7
466	66839	9	66848	10	66857	9	66867	10	66876	9	66885	10	66894	9	66904	10	66913	9	66922	10	
467	66932	9	66941	10	66950	9	66960	10	66969	9	66978	10	66987	9	66997	10	67006	9	67015	10	
468	67025	9	67034	10	67043	9	67052	10	67062	9	67071	10	67080	9	67089	10	67099	9	67108	10	
469	67117	10	67127	9	67136	10	67145	9	67154	10	67164	9	67173	10	67182	9	67191	10	67201	9	
470	67210	9	67219	10	67228	9	67237	10	67247	9	67256	10	67265	9	67274	10	67284	9	67293	10	9 1 2 3 4 5 6 7 8
471	67302	9	67311	10	67321	9	67330	10	67339	9	67348	10	67357	9	67367	10	67376	9	67385	10	
472	67394	9	67403	10	67413	9	67422	10	67431	9	67440	10	67449	9	67459	10	67468	9	67477	10	
473	67486	9	67495	10	67504	9	67514	10	67523	9	67532	10	67541	9	67550	10	67560	9	67569	10	
474	67578	9	67587	10	67596	9	67605	10	67614	9	67624	10	67633	9	67642	10	67651	9	67660	10	
475	67669	10	67679	9	67688	10	67697	9	67706	10	67715	9	67724	10	67733	9	67742	10	67752	9	8 1 2 3 4 5 6 7 8
476	67761	9	67770	10	67779	9	67788	10	67797	9	67806	10	67815	9	67825	10	67834	9	67843	10	
477	67852	9	67861	10	67870	9	67879	10	67888	9	67897	10	67906	9	67916	10	67925	9	67934	10	
478	67943	9	67952	10	67961	9	67970	10	67979	9	67988	10	67997	9	68006	10	68015	9	68024	10	
479	68034	9	68043	10	68052	9	68061	10	68070	9	68079	10	68088	9	68097	10	68106	9	68115	10	
480	68124	9	68133	10	68142	9	68151	10	68160	9	68169	10	68178	9	68187	10	68196	9	68205	10	7 1 2 3 4 5 6 7
481	68215	9	68224	10	68233	9	68242	10	68251	9	68260	10	68269	9	68278	10	68287	9	68296	10	
482	68305	9	68314	10	68323	9	68332	10	68341	9	68350	10	68359	9	68368	10	68377	9	68386	10	
483	68395	9	68404	10	68413	9	68422	10	68431	9	68440	10	68449	9	68458	10	68467	9	68476	10	
484	68485	9	68494	10	68502	9	68511	10	68520	9	68529	10	68538	9	68547	10	68556	9	68565	10	
485	68574	9	68583	10	68592	9	68601	10	68610	9	68619	10	68628	9	68637	10	68646	9	68655	10	6 1 2 3 4 5 6
486	68664	9	68673	10	68681	9	68690	10	68699	9	68708	10	68717	9	68726	10	68735	9	68744	10	
487	68753	9	68762	10	68771	9	68780	10	68789	9	68797	10	68806	9	68815	10	68824	9	68833	10	
488	68842	9	68851	10	68860	9	68869	10	68878	9	68886	10	68895	9	68904	10	68913	9	68922	10	
489	68931	9	68940	10	68949	9	68958	10	68966	9	68975	10	68984	9	68993	10	69002	9	69011	10	
490	69020	9	69028	10	69037	9	69046	10	69055	9	69064	10	69073	9	69082	10	69090	9	69099	10	8 1 2 3 4 5 6 7
491	69108	9	69117	10	69126	9	69135	10	69144	9	69152	10	69161	9	69170	10	69179	9	69188	10	
492	69197	9	69205	10	69214	9	69223	10	69232	9	69241	10	69249	9	69258	10	69267	9	69276	10	
493	69285	9	69294	10	69302	9	69311	10	69320	9	69329	10	69338	9	69346	10	69355	9	69364	10	
494	69373	9	69381	10	69390	9	69399	10	69408	9	69417	10	69425	9	69434	10	69443	9	69452	10	
495	69461	9	69469	10	69478	9	69487	10	69496	9	69504	10	69513	9	69522	10	69531	9	69539	10	7 1 2 3 4 5 6 7
496	69548	9	69557	10	69566	9	69574	10	69583	9	69592	10	69601	9	69609	10	69618	9	69627	10	
497	69636	9	69644	10	69653	9	69662	10	69671	9	69679	10	69688	9	69697	10	69705	9	69714	10	
498	69723	9	69732	10	69740	9	69749	10	69758	9	69767	10	69775	9	69784	10	69793	9	69801	10	
499	69810	9	69819	10	69827	9	69836	10	69845	9	69854	10	69862	9	69871	10	69880	9	69888	10	
500	69897	9	69906	10	69914	9	69923	10	69932	9	69940	10	69949	9	69958	10	69966	9	69975	10	
No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	

Logarithms of Numbers

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5000-5500

No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	Prop. parts
500	69897		69906		69914		69923		69932		69940		69949		69958		69966		69975		
501	69984		69992		70001		70010		70018		70027		70036		70044		70053		70062		9
502	70070		70079		70088		70096		70105		70114		70122		70131		70140		70148		
503	70157		70165		70174		70183		70191		70200		70209		70217		70226		70234		1
504	70243		70252		70260		70269		70278		70286		70295		70303		70312		70321		2
505	70329		70338		70346		70355		70364		70372		70381		70389		70398		70406		3
506	70415		70424		70432		70441		70449		70458		70467		70475		70484		70492		4
507	70501		70509		70518		70526		70535		70544		70552		70561		70569		70578		5
508	70586		70595		70603		70612		70621		70629		70638		70646		70655		70663		6
509	70672		70680		70689		70697		70706		70714		70723		70731		70740		70749		7
510	70757		70766		70774		70783		70791		70800		70808		70817		70825		70834		8
511	70842		70851		70859		70868		70876		70885		70893		70902		70910		70919		
512	70927		70935		70944		70952		70961		70969		70978		70986		70995		71003		
513	71012		71020		71029		71037		71046		71054		71063		71071		71079		71088		
514	71096		71105		71113		71122		71130		71139		71147		71155		71164		71172		
515	71181		71189		71198		71206		71214		71223		71231		71240		71248		71257		
516	71265		71273		71282		71290		71299		71307		71315		71324		71332		71341		
517	71349		71357		71366		71374		71383		71391		71399		71408		71416		71425		
518	71433		71441		71450		71458		71466		71475		71483		71492		71500		71508		
519	71517		71525		71533		71542		71550		71559		71567		71575		71584		71592		
520	71600		71609		71617		71625		71634		71642		71650		71659		71667		71675		8
521	71684		71692		71700		71709		71717		71725		71734		71742		71750		71759		
522	71767		71775		71784		71792		71800		71809		71817		71825		71834		71842		
523	71850		71858		71867		71875		71883		71892		71900		71908		71917		71925		1
524	71933		71941		71950		71958		71966		71975		71983		71991		71999		72008		2
525	72016		72024		72032		72041		72049		72057		72066		72074		72082		72090		3
526	72099		72107		72115		72123		72132		72140		72148		72156		72165		72173		4
527	72181		72189		72198		72206		72214		72222		72230		72239		72247		72255		5
528	72263		72272		72280		72288		72296		72304		72313		72321		72329		72337		6
529	72346		72354		72362		72370		72378		72387		72395		72403		72411		72419		7
530	72428		72436		72444		72452		72460		72469		72477		72485		72493		72501		
531	72509		72518		72526		72534		72542		72550		72558		72567		72575		72583		
532	72591		72599		72607		72616		72624		72632		72640		72648		72656		72665		
533	72673		72681		72689		72697		72705		72713		72722		72730		72738		72746		
534	72754		72762		72770		72779		72787		72795		72803		72811		72819		72827		
535	72835		72843		72852		72860		72868		72876		72884		72892		72900		72908		
536	72916		72925		72933		72941		72949		72957		72965		72973		72981		72989		
537	72997		73006		73014		73022		73030		73038		73046		73054		73062		73070		
538	73078		73086		73094		73102		73111		73119		73127		73135		73143		73151		
539	73159		73167		73175		73183		73191		73199		73207		73215		73223		73231		
540	73239		73247		73255		73263		73272		73280		73288		73296		73304		73312		7
541	73320		73328		73336		73344		73352		73360		73368		73376		73384		73392		
542	73400		73408		73416		73424		73432		73440		73448		73456		73464		73472		
543	73480		73488		73496		73504		73512		73520		73528		73536		73544		73552		
544	73560		73568		73576		73584		73592		73600		73608		73616		73624		73632		1
545	73640		73648		73656		73664		73672		73679		73687		73695		73703		73711		2
546	73719		73727		73735		73743		73751		73759		73767		73775		73783		73791		3
547	73799		73807		73815		73823		73830		73838		73846		73854		73862		73870		4
548	73878		73886		73894		73902		73910		73918		73926		73933		73941		73949		5
549	73957		73965		73973		73981		73989		73997		74005		74013		74020		74028		6
550	74036		74044		74052		74060		74068		74076		74084		74092		74099		74107		6
No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	

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5500-6000

No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	Prop. parts
550	74036		874044		874052		874060		874068		874076		874084		874092		774099		874107		8
551	74115		874123		874131		874139		874147		874155		874162		874170		874178		874186		
552	74194		874202		874210		874218		874225		874233		874241		874249		874257		874265		1
553	74273		874280		874288		874296		874304		874312		874320		874327		874335		874343		2
554	74351		874359		874367		874374		874382		874390		874398		874406		874414		874421		3
555	74429		874437		874445		874453		874461		874468		874476		874484		874492		874500		4
556	74507		874515		874523		874531		874539		874547		874554		874562		874570		874578		5
557	74586		874593		874601		874609		874617		874624		874632		874640		874648		874656		6
558	74663		874671		874679		874687		874695		874702		874710		874718		874726		874733		7
559	74741		874749		874757		874764		874772		874780		874788		874796		874803		874811		8
560	74819		874827		874834		874842		874850		874858		874865		874873		874881		874889		
561	74896		874904		874912		874920		874927		874935		874943		874950		874958		874966		1
562	74974		874981		874989		874997		875005		875012		875020		875028		875035		875043		2
563	75051		875059		875066		875074		875082		875089		875097		875105		875113		875120		3
564	75128		875136		875143		875151		875159		875166		875174		875182		875189		875197		4
565	75205		875213		875220		875228		875236		875243		875251		875259		875266		875274		5
566	75282		875289		875297		875305		875312		875320		875328		875335		875343		875351		6
567	75358		875366		875374		875381		875389		875397		875404		875412		875420		875427		7
568	75435		875442		875450		875458		875465		875473		875481		875488		875496		875504		8
569	75511		875519		875526		875534		875542		875549		875557		875565		875572		875580		9
570	75587		875595		875603		875610		875618		875626		875633		875641		875648		875656		
571	75664		875671		875679		875686		875694		875702		875709		875717		875724		875732		1
572	75740		875747		875755		875762		875770		875778		875785		875793		875800		875808		2
573	75815		875823		875831		875838		875846		875853		875861		875868		875876		875884		3
574	75891		875899		875906		875914		875921		875929		875937		875944		875952		875959		4
575	75967		875974		875982		875989		875997		876005		876012		876020		876027		876035		
576	76042		876050		876057		876065		876072		876080		876087		876095		876103		876110		1
577	76118		876125		876133		876140		876148		876155		876163		876170		876178		876185		2
578	76193		876200		876208		876215		876223		876230		876238		876245		876253		876260		3
579	76268		876275		876283		876290		876298		876305		876313		876320		876328		876335		4
580	76343		876350		876358		876365		876373		876380		876388		876395		876403		876410		
581	76418		876425		876433		876440		876448		876455		876462		876470		876477		876485		1
582	76492		876500		876507		876515		876522		876530		876537		876545		876552		876559		2
583	76567		876574		876582		876589		876597		876604		876612		876619		876626		876634		3
584	76641		876649		876656		876664		876671		876678		876686		876693		876701		876708		4
585	76716		876723		876730		876738		876745		876753		876760		876768		876775		876782		
586	76790		876797		876805		876812		876819		876827		876834		876842		876849		876856		1
587	76864		876871		876879		876886		876893		876901		876908		876916		876923		876930		2
588	76938		876945		876953		876960		876967		876975		876982		876989		876997		877004		3
589	77012		877019		877026		877034		877041		877048		877056		877063		877070		877078		4
590	77085		877093		877100		877107		877115		877122		877129		877137		877144		877151		
591	77159		877166		877173		877181		877188		877195		877203		877210		877217		877225		7
592	77232		877240		877247		877254		877262		877269		877276		877283		877291		877298		
593	77305		877313		877320		877327		877335		877342		877349		877357		877364		877371		1
594	77379		877386		877393		877401		877408		877415		877422		877430		877437		877444		2
595	77452		877459		877466		877474		877481		877488		877495		877503		877510		877517		3
596	77525		877532		877539		877546		877554		877561		877568		877576		877583		877590		4
597	77597		877605		877612		877619		877627		877634		877641		877648		877656		877663		5
598	77670		877677		877685		877692		877699		877706		877714		877721		877728		877735		6
599	77743		877750		877757		877764		877772		877779		877786		877793		877801		877808		7
600	77815		877822		877830		877837		877844		877851		877859		877866		877873		877880		8
No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	

5000-5500

No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	Prop. parts
500	69897		69906		69914		69923		69932		69940		69949		69958		69966		69975		
501	69984		69992		70001		70010		70018		70027		70036		70044		70053		70062		9
502	70070		70079		70088		70096		70105		70114		70122		70131		70140		70148		1
503	70157		70165		70174		70183		70191		70200		70209		70217		70226		70234		2
504	70243		70252		70260		70269		70278		70286		70295		70303		70312		70321		3
505	70329		70338		70346		70355		70364		70372		70381		70389		70398		70406		4
506	70415		70424		70432		70441		70449		70458		70467		70475		70484		70492		5
507	70501		70509		70518		70526		70535		70544		70552		70561		70569		70578		6
508	70586		70595		70603		70612		70621		70629		70638		70646		70655		70663		7
509	70672		70680		70689		70697		70706		70714		70723		70731		70740		70749		8
510	70757		70766		70774		70783		70791		70800		70808		70817		70825		70834		9
511	70842		70851		70859		70868		70876		70885		70893		70902		70910		70919		
512	70927		70935		70944		70952		70961		70969		70978		70986		70995		71003		
513	71012		71020		71029		71037		71046		71054		71063		71071		71079		71088		
514	71096		71105		71113		71122		71130		71139		71147		71155		71164		71172		
515	71181		71189		71198		71206		71214		71223		71231		71240		71248		71257		
516	71265		71273		71282		71290		71299		71307		71315		71324		71332		71341		
517	71349		71357		71366		71374		71383		71391		71399		71408		71416		71425		
518	71433		71441		71450		71458		71466		71475		71483		71492		71500		71508		
519	71517		71525		71533		71542		71550		71559		71567		71575		71584		71592		
520	71600		71609		71617		71625		71634		71642		71650		71659		71667		71675		8
521	71684		71692		71700		71709		71717		71725		71734		71742		71750		71759		
522	71767		71775		71784		71792		71800		71809		71817		71825		71834		71842		1
523	71850		71858		71867		71875		71883		71892		71900		71908		71917		71925		2
524	71933		71941		71950		71958		71966		71975		71983		71991		71999		72008		3
525	72016		72024		72032		72041		72049		72057		72066		72074		72082		72090		4
526	72099		72107		72115		72123		72132		72140		72148		72156		72165		72173		5
527	72181		72189		72198		72206		72214		72222		72230		72239		72247		72255		6
528	72263		72272		72280		72288		72296		72304		72313		72321		72329		72337		7
529	72346		72354		72362		72370		72378		72387		72395		72403		72411		72419		8
530	72428		72436		72444		72452		72460		72469		72477		72485		72493		72501		
531	72509		72518		72526		72534		72542		72550		72558		72567		72575		72583		1
532	72591		72599		72607		72616		72624		72632		72640		72648		72656		72665		2
533	72673		72681		72689		72697		72705		72713		72722		72730		72738		72746		3
534	72754		72762		72770		72779		72787		72795		72803		72811		72819		72827		4
535	72835		72843		72852		72860		72868		72876		72884		72892		72900		72908		5
536	72916		72925		72933		72941		72949		72957		72965		72973		72981		72989		6
537	72997		73006		73014		73022		73030		73038		73046		73054		73062		73070		7
538	73078		73086		73094		73102		73111		73119		73127		73135		73143		73151		
539	73159		73167		73175		73183		73191		73199		73207		73215		73223		73231		
540	73239		73247		73255		73263		73272		73280		73288		73296		73304		73312		
541	73320		73328		73336		73344		73352		73360		73368		73376		73384		73392		7
542	73400		73408		73416		73424		73432		73440		73448		73456		73464		73472		1
543	73480		73488		73496		73504		73512		73520		73528		73536		73544		73552		2
544	73560		73568		73576		73584		73592		73600		73608		73616		73624		73632		3
545	73640		73648		73656		73664		73672		73679		73687		73695		73703		73711		4
546	73719		73727		73735		73743		73751		73759		73767		73775		73783		73791		5
547	73799		73807		73815		73823		73830		73838		73846		73854		73862		73870		6
548	73878		73886		73894		73902		73910		73918		73926		73933		73941		73949		7
549	73957		73965		73973		73981		73989		73997		74005		74013		74020		74028		8
550	74036		74044		74052		74060		74068		74076		74084		74092		74099		74107		9
No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	

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Logarithms of Numbers

5500-6000

No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	Prop. parts
550	74036		874044		874052		874060		874068		874076		874084		874092		874099		874107		8
551	74115		874123		874131		874139		874147		874155		874162		874170		874178		874186		
552	74194		874202		874210		874218		874225		874233		874241		874249		874257		874265		1
553	74273		874280		874288		874296		874304		874312		874320		874327		874335		874343		2
554	74351		874359		874367		874374		874382		874390		874398		874406		874414		874421		3
555	74429		874437		874445		874453		874461		874468		874476		874484		874492		874500		4
556	74507		874515		874523		874531		874539		874547		874554		874562		874570		874578		5
557	74586		874593		874601		874609		874617		874624		874632		874640		874648		874656		6
558	74663		874671		874679		874687		874695		874702		874710		874718		874726		874733		7
559	74741		874749		874757		874764		874772		874780		874788		874796		874803		874811		8
560	74819		874827		874834		874842		874850		874858		874865		874873		874881		874889		
561	74896		874904		874912		874920		874927		874935		874943		874950		874958		874966		
562	74974		874981		874989		874997		875005		875012		875020		875028		875035		875043		
563	75051		875059		875066		875074		875082		875089		875097		875105		875113		875120		
564	75128		875136		875143		875151		875159		875166		875174		875182		875189		875197		
565	75205		875213		875220		875228		875236		875243		875251		875259		875266		875274		
566	75282		875289		875297		875305		875312		875320		875328		875335		875343		875351		
567	75358		875366		875374		875381		875389		875397		875404		875412		875420		875427		
568	75435		875442		875450		875458		875465		875473		875481		875488		875496		875504		
569	75511		875519		875526		875534		875542		875549		875557		875565		875572		875580		
570	75587		875595		875603		875610		875618		875626		875633		875641		875648		875656		
571	75664		875671		875679		875686		875694		875702		875709		875717		875724		875732		
572	75740		875747		875755		875762		875770		875778		875785		875793		875800		875808		
573	75815		875823		875831		875838		875846		875853		875861		875868		875876		875884		
574	75891		875899		875906		875914		875921		875929		875937		875944		875952		875959		
575	75967		875974		875982		875989		875997		876005		876012		876020		876027		876035		
576	76042		876050		876057		876065		876072		876080		876087		876095		876103		876110		
577	76118		876125		876133		876140		876148		876155		876163		876170		876178		876185		
578	76193		876200		876208		876215		876223		876230		876238		876245		876253		876260		
579	76268		876275		876283		876290		876298		876305		876313		876320		876328		876335		
580	76343		876350		876358		876365		876373		876380		876388		876395		876403		876410		
581	76418		876425		876433		876440		876448		876455		876462		876470		876477		876485		
582	76492		876500		876507		876515		876522		876530		876537		876545		876552		876559		
583	76567		876574		876582		876589		876597		876604		876612		876619		876626		876634		
584	76641		876649		876656		876664		876671		876678		876686		876693		876701		876708		
585	76716		876723		876730		876738		876745		876753		876760		876768		876775		876782		
586	76790		876797		876805		876812		876819		876827		876834		876842		876849		876856		
587	76864		876871		876879		876886		876893		876901		876908		876916		876923		876930		
588	76938		876945		876953		876960		876967		876975		876982		876989		876997		877004		
589	77012		877019		877026		877034		877041		877048		877056		877063		877070		877078		
590	77085		877093		877100		877107		877115		877122		877129		877137		877144		877151		
591	77159		877166		877173		877181		877188		877195		877203		877210		877217		877225		7
592	77232		877240		877247		877254		877262		877269		877276		877283		877291		877298		
593	77305		877313		877320		877327		877335		877342		877349		877357		877364		877371		
594	77379		877386		877393		877401		877408		877415		877422		877430		877437		877444		
595	77452		877459		877466		877474		877481		877488		877495		877503		877510		877517		
596	77525		877532		877539		877546		877554		877561		877568		877576		877583		877590		
597	77597		877605		877612		877619		877627		877634		877641		877648		877656		877663		
598	77670		877677		877685		877692		877699		877706		877714		877721		877728		877735		
599	77743		877750		877757		877764		877772		877779		877786		877793		877801		877808		
600	77815		877822		877830		877837		877844		877851		877859		877866		877873		877880		
No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	

Logarithms of Numbers

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6000-6500

No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	Prop. parts
600	77815		77822		77830		77837		77844		77851		77859		77866		77873		77880		8
601	77887		77895		77902		77909		77916		77924		77931		77938		77945		77952		
602	77960		77967		77974		77981		77988		77996		78003		78010		78017		78025		1
603	78032		78039		78046		78053		78061		78068		78075		78082		78089		78097		2
604	78104		78111		78118		78125		78132		78140		78147		78154		78161		78168		3
605	78176		78183		78190		78197		78204		78211		78219		78226		78233		78240		4
606	78247		78254		78262		78269		78276		78283		78290		78297		78305		78312		5
607	78319		78326		78333		78340		78347		78355		78362		78369		78376		78383		6
608	78390		78398		78405		78412		78419		78426		78433		78440		78447		78455		7
609	78462		78469		78476		78483		78490		78497		78504		78512		78519		78526		8
610	78533		78540		78547		78554		78561		78569		78576		78583		78590		78597		9
611	78604		78611		78618		78625		78633		78640		78647		78654		78661		78668		
612	78675		78682		78689		78696		78704		78711		78718		78725		78732		78739		
613	78746		78753		78760		78767		78774		78781		78789		78796		78803		78810		
614	78817		78824		78831		78838		78845		78852		78859		78866		78873		78880		
615	78888		78895		78902		78909		78916		78923		78930		78937		78944		78951		
616	78958		78965		78972		78979		78986		78993		79000		79007		79014		79021		
617	79029		79036		79043		79050		79057		79064		79071		79078		79085		79092		
618	79099		79106		79113		79120		79127		79134		79141		79148		79155		79162		
619	79169		79176		79183		79190		79197		79204		79211		79218		79225		79232		
620	79239		79246		79253		79260		79267		79274		79281		79288		79295		79302		
621	79309		79316		79323		79330		79337		79344		79351		79358		79365		79372		7
622	79379		79386		79393		79400		79407		79414		79421		79428		79435		79442		
623	79449		79456		79463		79470		79477		79484		79491		79498		79505		79511		1
624	79518		79525		79532		79539		79546		79553		79560		79567		79574		79581		2
625	79588		79595		79602		79609		79616		79623		79630		79637		79644		79650		3
626	79657		79664		79671		79678		79685		79692		79699		79706		79713		79720		4
627	79727		79734		79741		79748		79755		79761		79768		79775		79782		79789		5
628	79796		79803		79810		79817		79824		79831		79837		79844		79851		79858		6
629	79865		79872		79879		79886		79893		79900		79906		79913		79920		79927		7
630	79934		79941		79948		79955		79962		79969		79975		79982		79989		79996		
631	80003		80010		80017		80024		80030		80037		80044		80051		80058		80065		
632	80072		80079		80085		80092		80099		80106		80113		80120		80127		80134		
633	80140		80147		80154		80161		80168		80175		80182		80188		80195		80202		
634	80209		80216		80223		80229		80236		80243		80250		80257		80264		80271		
635	80277		80284		80291		80298		80305		80312		80318		80325		80332		80339		
636	80346		80353		80359		80366		80373		80380		80387		80393		80400		80407		
637	80414		80421		80428		80434		80441		80448		80455		80462		80468		80475		
638	80482		80489		80496		80502		80509		80516		80523		80530		80536		80543		
639	80550		80557		80564		80570		80577		80584		80591		80598		80604		80611		
640	80618		80625		80632		80638		80645		80652		80659		80665		80672		80679		
641	80686		80693		80699		80706		80713		80720		80726		80733		80740		80747		
642	80754		80760		80767		80774		80781		80787		80794		80801		80808		80814		
643	80821		80828		80835		80841		80848		80855		80862		80868		80875		80882		
644	80889		80895		80902		80909		80916		80922		80929		80936		80943		80949		
645	80956		80963		80969		80976		80983		80990		80996		81003		81010		81017		
646	81023		81030		81037		81043		81050		81057		81064		81070		81077		81084		
647	81090		81097		81104		81111		81117		81124		81131		81137		81144		81151		
648	81158		81164		81171		81178		81184		81191		81198		81204		81211		81218		
649	81224		81231		81238		81245		81251		81258		81265		81271		81278		81285		
650	81291		81298		81305		81311		81318		81325		81331		81338		81345		81351		
No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	

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Logarithms of Numbers

6500-7000

No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	Prop. parts
650	81291	7	81298	7	81305	6	81311	7	81318	7	81325	6	81331	7	81338	7	81345	6	81351	7	7 1 2 3 4 5 6 7 8 9 1 2 3 4 5 6
651	81358	7	81365	6	81371	7	81378	7	81385	6	81391	7	81398	7	81405	6	81411	7	81418	7	
652	81425	6	81431	7	81438	7	81445	6	81451	7	81458	7	81465	6	81471	7	81478	7	81485	6	
653	81491	7	81498	7	81505	6	81511	7	81518	7	81525	6	81531	7	81538	6	81544	7	81551	7	
654	81558	6	81564	7	81571	7	81578	6	81584	7	81591	7	81598	6	81604	7	81611	6	81617	7	
655	81624	7	81631	6	81637	7	81644	7	81651	6	81657	7	81664	7	81671	6	81677	7	81684	6	
656	81690	7	81697	7	81704	6	81710	7	81717	6	81723	7	81730	7	81737	6	81743	7	81750	7	
657	81757	6	81763	7	81770	6	81776	7	81783	7	81790	6	81796	7	81803	6	81809	7	81816	7	
658	81823	6	81829	7	81836	6	81842	7	81849	7	81856	6	81862	7	81869	6	81875	7	81882	7	
659	81889	6	81895	7	81902	6	81908	7	81915	6	81921	7	81928	7	81935	6	81941	7	81948	6	
660	81954	7	81961	6	81968	7	81974	7	81981	6	81987	7	81994	6	82000	7	82007	7	82014	6	6 7 8 9 1 2 3 4 5 6 7 8 9 1 2 3 4 5 6
661	82020	7	82027	6	82033	7	82040	6	82046	7	82053	7	82060	6	82066	7	82073	6	82079	7	
662	82086	6	82092	7	82099	6	82105	7	82112	7	82119	6	82125	7	82132	6	82138	7	82145	6	
663	82151	7	82158	6	82164	7	82171	7	82178	6	82184	7	82191	6	82197	7	82204	6	82210	7	
664	82217	6	82223	7	82230	6	82236	7	82243	6	82249	7	82256	7	82263	6	82269	7	82276	6	
665	82282	7	82289	6	82295	7	82302	6	82308	7	82315	6	82321	7	82328	6	82334	7	82341	6	
666	82347	7	82354	6	82360	7	82367	6	82373	7	82380	6	82387	7	82393	6	82400	7	82406	6	
667	82413	6	82419	7	82426	6	82432	7	82439	6	82445	7	82452	6	82458	7	82465	6	82471	7	
668	82478	6	82484	7	82491	6	82497	7	82504	6	82510	7	82517	6	82523	7	82530	6	82536	7	
669	82543	6	82549	7	82556	6	82562	7	82569	6	82575	7	82582	6	82588	7	82595	6	82601	7	
670	82607	7	82614	6	82620	7	82627	6	82633	7	82640	6	82646	7	82653	6	82659	7	82666	6	5 6 7 8 9 1 2 3 4 5 6 7 8 9 1 2 3 4 5 6
671	82672	7	82679	6	82685	7	82692	6	82698	7	82705	6	82711	7	82718	6	82724	7	82730	7	
672	82737	6	82743	7	82750	6	82756	7	82763	6	82769	7	82776	6	82782	7	82789	6	82795	7	
673	82802	6	82808	7	82814	6	82821	7	82827	6	82834	7	82840	6	82847	7	82853	6	82860	7	
674	82866	6	82872	7	82879	6	82885	7	82892	6	82898	7	82905	6	82911	7	82918	6	82924	7	
675	82930	7	82937	6	82943	7	82950	6	82956	7	82963	6	82969	7	82975	6	82982	7	82988	6	
676	82995	6	83001	7	83008	6	83014	7	83020	6	83027	7	83033	6	83039	7	83046	6	83052	7	
677	83059	6	83065	7	83072	6	83078	7	83085	6	83091	7	83097	6	83104	7	83110	6	83117	7	
678	83123	6	83129	7	83136	6	83142	7	83149	6	83155	7	83161	6	83168	7	83174	6	83181	7	
679	83187	6	83193	7	83200	6	83206	7	83213	6	83219	7	83225	6	83232	7	83238	6	83245	7	
680	83251	6	83257	7	83264	6	83270	7	83276	6	83283	7	83289	6	83296	7	83302	6	83308	7	4 5 6 7 8 9 1 2 3 4 5 6 7 8 9 1 2 3 4 5 6
681	83315	6	83321	7	83327	6	83334	7	83340	6	83347	7	83353	6	83359	7	83366	6	83372	7	
682	83378	7	83385	6	83391	7	83398	6	83404	7	83410	6	83417	7	83423	6	83429	7	83436	6	
683	83442	6	83448	7	83455	6	83461	7	83467	6	83474	7	83480	6	83487	7	83493	6	83499	7	
684	83506	6	83512	7	83518	6	83525	7	83531	6	83537	7	83544	6	83550	7	83556	6	83563	7	
685	83569	6	83575	7	83582	6	83588	7	83594	6	83601	7	83607	6	83613	7	83620	6	83626	7	
686	83632	7	83639	6	83645	7	83651	6	83658	7	83664	6	83670	7	83677	6	83683	7	83689	6	
687	83696	6	83702	7	83708	6	83715	7	83721	6	83727	7	83734	6	83740	7	83746	6	83753	7	
688	83759	6	83765	7	83771	6	83778	7	83784	6	83790	7	83797	6	83803	7	83809	6	83816	7	
689	83822	6	83828	7	83835	6	83841	7	83847	6	83853	7	83860	6	83866	7	83872	6	83879	7	
690	83885	6	83891	7	83897	6	83904	7	83910	6	83916	7	83923	6	83929	7	83935	6	83942	7	3 4 5 6 7 8 9 1 2 3 4 5 6 7 8 9 1 2 3 4 5 6
691	83948	6	83954	7	83960	6	83967	7	83973	6	83979	7	83985	6	83992	7	83998	6	84004	7	
692	84011	6	84017	7	84023	6	84029	7	84036	6	84042	7	84048	6	84055	7	84061	6	84067	7	
693	84073	6	84080	7	84086	6	84092	7	84098	6	84105	7	84111	6	84117	7	84123	6	84130	7	
694	84136	6	84142	7	84148	6	84155	7	84161	6	84167	7	84173	6	84180	7	84186	6	84192	7	
695	84198	7	84205	6	84211	7	84217	6	84223	7	84230	6	84236	7	84242	6	84248	7	84255	6	
696	84261	6	84267	7	84273	6	84280	7	84286	6	84292	7	84298	6	84305	7	84311	6	84317	7	
697	84323	7	84330	6	84336	7	84342	6	84348	7	84354	6	84361	7	84367	6	84373	7	84379	6	
698	84386	6	84392	7	84398	6	84404	7	84410	6	84417	7	84423	6	84429	7	84435	6	84442	7	
699	84448	6	84454	7	84460	6	84466	7	84473	6	84479	7	84485	6	84491	7	84497	6	84504	7	
700	84510	6	84516	7	84522	6	84528	7	84535	6	84541	7	84547	6	84553	7	84559	6	84566	7	
No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	

7000-7500

No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	Prop. parts
700	84510	d	84516	d	84522	d	84528	d	84535	d	84541	d	84547	d	84553	d	84559	d	84566	d	7
701	84572	d	84578	d	84584	d	84590	d	84597	d	84603	d	84609	d	84615	d	84621	d	84628	d	
702	84634	d	84640	d	84646	d	84652	d	84658	d	84665	d	84671	d	84677	d	84683	d	84689	d	
703	84696	d	84702	d	84708	d	84714	d	84720	d	84726	d	84733	d	84739	d	84745	d	84751	d	
704	84757	d	84763	d	84770	d	84776	d	84782	d	84788	d	84794	d	84800	d	84807	d	84813	d	1 2 3 4 5 6 7 8 9
705	84819	d	84825	d	84831	d	84837	d	84844	d	84850	d	84856	d	84862	d	84868	d	84874	d	
706	84880	d	84887	d	84893	d	84899	d	84905	d	84911	d	84917	d	84924	d	84930	d	84936	d	
707	84942	d	84948	d	84954	d	84960	d	84967	d	84973	d	84979	d	84985	d	84991	d	84997	d	
708	85003	d	85009	d	85016	d	85022	d	85028	d	85034	d	85040	d	85046	d	85052	d	85058	d	1 2 3 4 5 6 7 8 9
709	85065	d	85071	d	85077	d	85083	d	85089	d	85095	d	85101	d	85107	d	85114	d	85120	d	
710	85126	d	85132	d	85138	d	85144	d	85150	d	85156	d	85163	d	85169	d	85175	d	85181	d	
711	85187	d	85193	d	85199	d	85205	d	85211	d	85217	d	85224	d	85230	d	85236	d	85242	d	
712	85248	d	85254	d	85260	d	85266	d	85272	d	85278	d	85285	d	85291	d	85297	d	85303	d	1 2 3 4 5 6 7 8 9
713	85309	d	85315	d	85321	d	85327	d	85333	d	85339	d	85345	d	85352	d	85358	d	85364	d	
714	85370	d	85376	d	85382	d	85388	d	85394	d	85400	d	85406	d	85412	d	85418	d	85425	d	
715	85431	d	85437	d	85443	d	85449	d	85455	d	85461	d	85467	d	85473	d	85479	d	85485	d	
716	85491	d	85497	d	85503	d	85509	d	85516	d	85522	d	85528	d	85534	d	85540	d	85546	d	1 2 3 4 5 6 7 8 9
717	85552	d	85558	d	85564	d	85570	d	85576	d	85582	d	85588	d	85594	d	85600	d	85606	d	
718	85612	d	85618	d	85625	d	85631	d	85637	d	85643	d	85649	d	85655	d	85661	d	85667	d	
719	85673	d	85679	d	85685	d	85691	d	85697	d	85703	d	85709	d	85715	d	85721	d	85727	d	
720	85733	d	85739	d	85745	d	85751	d	85757	d	85763	d	85769	d	85775	d	85781	d	85788	d	6
721	85794	d	85800	d	85806	d	85812	d	85818	d	85824	d	85830	d	85836	d	85842	d	85848	d	
722	85854	d	85860	d	85866	d	85872	d	85878	d	85884	d	85890	d	85896	d	85902	d	85908	d	
723	85914	d	85920	d	85926	d	85932	d	85938	d	85944	d	85950	d	85956	d	85962	d	85968	d	
724	85974	d	85980	d	85986	d	85992	d	85998	d	86004	d	86010	d	86016	d	86022	d	86028	d	1 2 3 4 5 6 7 8 9
725	86034	d	86040	d	86046	d	86052	d	86058	d	86064	d	86070	d	86076	d	86082	d	86088	d	
726	86094	d	86100	d	86106	d	86112	d	86118	d	86124	d	86130	d	86136	d	86141	d	86147	d	
727	86153	d	86159	d	86165	d	86171	d	86177	d	86183	d	86189	d	86195	d	86201	d	86207	d	
728	86213	d	86219	d	86225	d	86231	d	86237	d	86243	d	86249	d	86255	d	86261	d	86267	d	1 2 3 4 5 6 7 8 9
729	86273	d	86279	d	86285	d	86291	d	86297	d	86303	d	86308	d	86314	d	86320	d	86326	d	
730	86332	d	86338	d	86344	d	86350	d	86356	d	86362	d	86368	d	86374	d	86380	d	86386	d	
731	86392	d	86398	d	86404	d	86410	d	86415	d	86421	d	86427	d	86433	d	86439	d	86445	d	
732	86451	d	86457	d	86463	d	86469	d	86475	d	86481	d	86487	d	86493	d	86499	d	86504	d	1 2 3 4 5 6 7 8 9
733	86510	d	86516	d	86522	d	86528	d	86534	d	86540	d	86546	d	86552	d	86558	d	86564	d	
734	86570	d	86576	d	86581	d	86587	d	86593	d	86599	d	86605	d	86611	d	86617	d	86623	d	
735	86629	d	86635	d	86641	d	86646	d	86652	d	86658	d	86664	d	86670	d	86676	d	86682	d	
736	86688	d	86694	d	86700	d	86705	d	86711	d	86717	d	86723	d	86729	d	86735	d	86741	d	1 2 3 4 5 6 7 8 9
737	86747	d	86753	d	86759	d	86764	d	86770	d	86776	d	86782	d	86788	d	86794	d	86800	d	
738	86806	d	86812	d	86817	d	86823	d	86829	d	86835	d	86841	d	86847	d	86853	d	86859	d	
739	86864	d	86870	d	86876	d	86882	d	86888	d	86894	d	86900	d	86906	d	86911	d	86917	d	
740	86923	d	86929	d	86935	d	86941	d	86947	d	86953	d	86958	d	86964	d	86970	d	86976	d	5
741	86982	d	86988	d	86994	d	86999	d	87005	d	87011	d	87017	d	87023	d	87029	d	87035	d	
742	87040	d	87046	d	87052	d	87058	d	87064	d	87070	d	87075	d	87081	d	87087	d	87093	d	
743	87099	d	87105	d	87111	d	87116	d	87122	d	87128	d	87134	d	87140	d	87146	d	87151	d	
744	87157	d	87163	d	87169	d	87175	d	87181	d	87186	d	87192	d	87198	d	87204	d	87210	d	1 2 3 4 5 6 7 8 9
745	87216	d	87221	d	87227	d	87233	d	87239	d	87245	d	87251	d	87256	d	87262	d	87268	d	
746	87274	d	87280	d	87286	d	87291	d	87297	d	87303	d	87309	d	87315	d	87320	d	87326	d	
747	87332	d	87338	d	87344	d	87349	d	87355	d	87361	d	87367	d	87373	d	87379	d	87384	d	
748	87390	d	87396	d	87402	d	87408	d	87413	d	87419	d	87425	d	87431	d	87437	d	87442	d	1 2 3 4 5 6 7 8 9
749	87448	d	87454	d	87460	d	87466	d	87471	d	87477	d	87483	d	87489	d	87495	d	87500	d	
750	87506	d	87512	d	87518	d	87523	d	87529	d	87535	d	87541	d	87547	d	87552	d	87558	d	
No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	

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Logarithms of Numbers

7500-8000

No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	Prop. parts
750	87506	d	87512	d	87518	d	87523	d	87529	d	87535	d	87541	d	87547	d	87552	d	87558	d	6
751	87564	d	87570	d	87576	d	87581	d	87587	d	87593	d	87599	d	87604	d	87610	d	87616	d	6
752	87622	d	87628	d	87633	d	87639	d	87645	d	87651	d	87656	d	87662	d	87668	d	87674	d	6
753	87679	d	87685	d	87691	d	87697	d	87703	d	87708	d	87714	d	87720	d	87726	d	87731	d	6
754	87737	d	87743	d	87749	d	87754	d	87760	d	87766	d	87772	d	87777	d	87783	d	87789	d	6
755	87795	d	87800	d	87806	d	87812	d	87818	d	87823	d	87829	d	87835	d	87841	d	87846	d	6
756	87852	d	87858	d	87864	d	87869	d	87875	d	87881	d	87887	d	87892	d	87898	d	87904	d	6
757	87910	d	87915	d	87921	d	87927	d	87933	d	87938	d	87944	d	87950	d	87955	d	87961	d	6
758	87967	d	87973	d	87978	d	87984	d	87990	d	87996	d	88001	d	88007	d	88013	d	88018	d	6
759	88024	d	88030	d	88036	d	88041	d	88047	d	88053	d	88058	d	88064	d	88070	d	88076	d	6
760	88081	d	88087	d	88093	d	88098	d	88104	d	88110	d	88116	d	88121	d	88127	d	88133	d	6
761	88138	d	88144	d	88150	d	88156	d	88161	d	88167	d	88173	d	88178	d	88184	d	88190	d	6
762	88195	d	88201	d	88207	d	88213	d	88218	d	88224	d	88230	d	88235	d	88241	d	88247	d	6
763	88252	d	88258	d	88264	d	88270	d	88275	d	88281	d	88287	d	88292	d	88298	d	88304	d	6
764	88309	d	88315	d	88321	d	88326	d	88332	d	88338	d	88343	d	88349	d	88355	d	88360	d	6
765	88366	d	88372	d	88377	d	88383	d	88389	d	88395	d	88400	d	88406	d	88412	d	88417	d	6
766	88423	d	88429	d	88434	d	88440	d	88446	d	88451	d	88457	d	88463	d	88468	d	88474	d	6
767	88480	d	88485	d	88491	d	88497	d	88502	d	88508	d	88513	d	88519	d	88525	d	88530	d	6
768	88536	d	88542	d	88547	d	88553	d	88559	d	88564	d	88570	d	88576	d	88581	d	88587	d	6
769	88593	d	88598	d	88604	d	88610	d	88615	d	88621	d	88627	d	88632	d	88638	d	88643	d	6
770	88649	d	88655	d	88660	d	88666	d	88672	d	88677	d	88683	d	88689	d	88694	d	88700	d	6
771	88705	d	88711	d	88717	d	88722	d	88728	d	88734	d	88739	d	88745	d	88750	d	88756	d	6
772	88762	d	88767	d	88773	d	88779	d	88784	d	88790	d	88795	d	88801	d	88807	d	88812	d	6
773	88818	d	88824	d	88829	d	88835	d	88840	d	88846	d	88852	d	88857	d	88863	d	88868	d	6
774	88874	d	88880	d	88885	d	88891	d	88897	d	88902	d	88908	d	88913	d	88919	d	88925	d	6
775	88930	d	88936	d	88941	d	88947	d	88953	d	88958	d	88964	d	88969	d	88975	d	88981	d	6
776	88986	d	88992	d	88997	d	89003	d	89009	d	89014	d	89020	d	89025	d	89031	d	89037	d	6
777	89042	d	89048	d	89053	d	89059	d	89064	d	89070	d	89076	d	89081	d	89087	d	89092	d	6
778	89098	d	89104	d	89109	d	89115	d	89120	d	89126	d	89131	d	89137	d	89143	d	89148	d	6
779	89154	d	89159	d	89165	d	89170	d	89176	d	89182	d	89187	d	89193	d	89198	d	89204	d	6
780	89209	d	89215	d	89221	d	89226	d	89232	d	89237	d	89243	d	89248	d	89254	d	89260	d	6
781	89265	d	89271	d	89276	d	89282	d	89287	d	89293	d	89298	d	89304	d	89310	d	89315	d	6
782	89321	d	89326	d	89332	d	89337	d	89343	d	89348	d	89354	d	89360	d	89365	d	89371	d	6
783	89376	d	89382	d	89387	d	89393	d	89398	d	89404	d	89409	d	89415	d	89421	d	89426	d	6
784	89432	d	89437	d	89443	d	89448	d	89454	d	89459	d	89465	d	89470	d	89476	d	89481	d	6
785	89487	d	89492	d	89498	d	89504	d	89509	d	89515	d	89520	d	89526	d	89531	d	89537	d	6
786	89542	d	89548	d	89553	d	89559	d	89564	d	89570	d	89575	d	89581	d	89586	d	89592	d	6
787	89597	d	89603	d	89609	d	89614	d	89620	d	89625	d	89631	d	89636	d	89642	d	89647	d	6
788	89653	d	89658	d	89664	d	89669	d	89675	d	89680	d	89686	d	89691	d	89697	d	89702	d	6
789	89708	d	89713	d	89719	d	89724	d	89730	d	89735	d	89741	d	89746	d	89752	d	89757	d	6
790	89763	d	89768	d	89774	d	89779	d	89785	d	89790	d	89796	d	89801	d	89807	d	89812	d	6
791	89818	d	89823	d	89829	d	89834	d	89840	d	89845	d	89851	d	89856	d	89862	d	89867	d	6
792	89873	d	89878	d	89883	d	89889	d	89894	d	89900	d	89905	d	89911	d	89916	d	89922	d	6
793	89927	d	89933	d	89938	d	89944	d	89949	d	89955	d	89960	d	89966	d	89971	d	89977	d	6
794	89982	d	89988	d	89993	d	89998	d	90004	d	90009	d	90015	d	90020	d	90026	d	90031	d	6
795	90037	d	90042	d	90048	d	90053	d	90059	d	90064	d	90069	d	90075	d	90080	d	90086	d	6
796	90091	d	90097	d	90102	d	90108	d	90113	d	90119	d	90124	d	90129	d	90135	d	90140	d	6
797	90146	d	90151	d	90157	d	90162	d	90168	d	90173	d	90179	d	90184	d	90189	d	90195	d	6
798	90200	d	90206	d	90211	d	90217	d	90222	d	90227	d	90233	d	90238	d	90244	d	90249	d	6
799	90255	d	90260	d	90266	d	90271	d	90276	d	90282	d	90287	d	90293	d	90298	d	90304	d	6
800	90309	d	90314	d	90320	d	90325	d	90331	d	90336	d	90342	d	90347	d	90352	d	90358	d	6
No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	

Logarithms of Numbers

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8000-8500

No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	Prop. parts
800	90309		90314		90320		90325		90331		90336		90342		90347		90352		90358		<div>6</div> <div>1 1</div> <div>2 1</div> <div>3 2</div> <div>4 2</div> <div>5 3</div> <div>6 4</div> <div>7 4</div> <div>8 5</div> <div>9 5</div>
801	90363		90369		90374		90380		90385		90390		90396		90401		90407		90412		
802	90417		90423		90428		90434		90439		90445		90450		90455		90461		90466		
803	90472		90477		90482		90488		90493		90499		90504		90509		90515		90520		
804	90526		90531		90536		90542		90547		90553		90558		90563		90569		90574		
805	90580		90585		90590		90596		90601		90607		90612		90617		90623		90628		
806	90634		90639		90644		90650		90655		90660		90666		90671		90677		90682		
807	90687		90693		90698		90703		90709		90714		90720		90725		90730		90736		
808	90741		90747		90752		90757		90763		90768		90773		90779		90784		90789		
809	90795		90800		90806		90811		90816		90822		90827		90832		90838		90843		
810	90849		90854		90859		90865		90870		90875		90881		90886		90891		90897		<div>5</div> <div>1 1</div> <div>2 2</div> <div>3 3</div> <div>4 4</div> <div>5 5</div> <div>6 5</div> <div>7 5</div> <div>8 5</div> <div>9 5</div>
811	90902		90907		90913		90918		90924		90929		90934		90940		90945		90950		
812	90956		90961		90966		90972		90977		90982		90988		90993		90998		91004		
813	91009		91014		91020		91025		91030		91036		91041		91046		91052		91057		
814	91062		91068		91073		91078		91084		91089		91094		91100		91105		91110		
815	91116		91121		91126		91132		91137		91142		91148		91153		91158		91164		
816	91169		91174		91180		91185		91190		91196		91201		91206		91212		91217		
817	91222		91228		91233		91238		91243		91249		91254		91259		91265		91270		
818	91275		91281		91286		91291		91297		91302		91307		91312		91318		91323		
819	91328		91334		91339		91344		91350		91355		91360		91365		91371		91376		
820	91381		91387		91392		91397		91403		91408		91413		91418		91424		91429		<div>5</div> <div>1 1</div> <div>2 2</div> <div>3 3</div> <div>4 4</div> <div>5 5</div> <div>6 5</div> <div>7 5</div> <div>8 5</div> <div>9 5</div>
821	91434		91440		91445		91450		91455		91461		91466		91471		91477		91482		
822	91487		91492		91498		91503		91508		91514		91519		91524		91529		91535		
823	91540		91545		91551		91556		91561		91566		91572		91577		91582		91587		
824	91593		91598		91603		91609		91614		91619		91624		91630		91635		91640		
825	91645		91651		91656		91661		91666		91672		91677		91682		91687		91693		
826	91698		91703		91709		91714		91719		91724		91730		91735		91740		91745		
827	91751		91756		91761		91766		91772		91777		91782		91787		91793		91798		
828	91803		91808		91814		91819		91824		91829		91834		91840		91845		91850		
829	91855		91861		91866		91871		91876		91882		91887		91892		91897		91903		
830	91908		91913		91918		91924		91929		91934		91939		91944		91950		91955		<div>5</div> <div>1 1</div> <div>2 2</div> <div>3 3</div> <div>4 4</div> <div>5 5</div> <div>6 5</div> <div>7 5</div> <div>8 5</div> <div>9 5</div>
831	91960		91965		91971		91976		91981		91986		91991		91997		92002		92007		
832	92012		92018		92023		92028		92033		92038		92044		92049		92054		92059		
833	92065		92070		92075		92080		92085		92091		92096		92101		92106		92111		
834	92117		92122		92127		92132		92137		92143		92148		92153		92158		92163		
835	92169		92174		92179		92184		92189		92195		92200		92205		92210		92215		
836	92221		92226		92231		92236		92241		92247		92252		92257		92262		92267		
837	92273		92278		92283		92288		92293		92298		92304		92309		92314		92319		
838	92324		92330		92335		92340		92345		92350		92355		92361		92366		92371		
839	92376		92381		92387		92392		92397		92402		92407		92412		92418		92423		
840	92428		92433		92438		92443		92449		92454		92459		92464		92469		92474		<div>5</div> <div>1 1</div> <div>2 2</div> <div>3 3</div> <div>4 4</div> <div>5 5</div> <div>6 5</div> <div>7 5</div> <div>8 5</div> <div>9 5</div>
841	92480		92485		92490		92495		92500		92505		92511		92516		92521		92526		
842	92531		92536		92542		92547		92552		92557		92562		92567		92572		92578		
843	92583		92588		92593		92598		92603		92609		92614		92619		92624		92629		
844	92634		92639		92645		92650		92655		92660		92665		92670		92675		92681		
845	92686		92691		92696		92701		92706		92711		92716		92722		92727		92732		
846	92737		92742		92747		92752		92758		92763		92768		92773		92778		92783		
847	92788		92793		92799		92804		92809		92814		92819		92824		92829		92834		
848	92840		92845		92850		92855		92860		92865		92870		92875		92881		92886		
849	92891		92896		92901		92906		92911		92916		92921		92927		92932		92937		
850	92942		92947		92952		92957		92962		92967		92973		92978		92983		92988		
No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	

8500-9000

No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	Prop. parts
850	92942		92947		92952		92957		92962		92967		92973		92978		92983		92988		6
851	92993		92998		93003		93008		93013		93018		93024		93029		93034		93039		
852	93044		93049		93054		93059		93064		93069		93075		93080		93085		93090		
853	93095		93100		93105		93110		93115		93120		93125		93131		93136		93141		
854	93146		93151		93156		93161		93166		93171		93176		93181		93186		93192		
855	93197		93202		93207		93212		93217		93222		93227		93232		93237		93242		1 2 3 4 5 6 7 8 9
856	93247		93252		93258		93263		93268		93273		93278		93283		93288		93293		
857	93298		93303		93308		93313		93318		93323		93328		93334		93339		93344		
858	93349		93354		93359		93364		93369		93374		93379		93384		93389		93394		
859	93399		93404		93409		93414		93420		93425		93430		93435		93440		93445		
860	93450		93455		93460		93465		93470		93475		93480		93485		93490		93495		
861	93500		93505		93510		93515		93520		93526		93531		93536		93541		93546		
862	93551		93556		93561		93566		93571		93576		93581		93586		93591		93596		
863	93601		93606		93611		93616		93621		93626		93631		93636		93641		93646		
864	93651		93656		93661		93666		93671		93676		93682		93687		93692		93697		
865	93702		93707		93712		93717		93722		93727		93732		93737		93742		93747		
866	93752		93757		93762		93767		93772		93777		93782		93787		93792		93797		
867	93802		93807		93812		93817		93822		93827		93832		93837		93842		93847		
868	93852		93857		93862		93867		93872		93877		93882		93887		93892		93897		
869	93902		93907		93912		93917		93922		93927		93932		93937		93942		93947		
870	93952		93957		93962		93967		93972		93977		93982		93987		93992		93997		5
871	94002		94007		94012		94017		94022		94027		94032		94037		94042		94047		
872	94052		94057		94062		94067		94072		94077		94082		94086		94091		94096		
873	94101		94106		94111		94116		94121		94126		94131		94136		94141		94146		
874	94151		94156		94161		94166		94171		94176		94181		94186		94191		94196		
875	94201		94206		94211		94216		94221		94226		94231		94236		94240		94245		1 2 3 4 5 6 7 8 9
876	94250		94255		94260		94265		94270		94275		94280		94285		94290		94295		
877	94300		94305		94310		94315		94320		94325		94330		94335		94340		94345		
878	94349		94354		94359		94364		94369		94374		94379		94384		94389		94394		
879	94399		94404		94409		94414		94419		94424		94429		94433		94438		94443		
880	94448		94453		94458		94463		94468		94473		94478		94483		94488		94493		
881	94498		94503		94507		94512		94517		94522		94527		94532		94537		94542		
882	94547		94552		94557		94562		94567		94571		94576		94581		94586		94591		
883	94596		94601		94606		94611		94616		94621		94626		94630		94635		94640		
884	94645		94650		94655		94660		94665		94670		94675		94680		94685		94689		
885	94694		94699		94704		94709		94714		94719		94724		94729		94734		94738		
886	94743		94748		94753		94758		94763		94768		94773		94778		94783		94787		
887	94792		94797		94802		94807		94812		94817		94822		94827		94832		94836		
888	94841		94846		94851		94856		94861		94866		94871		94876		94880		94885		
889	94890		94895		94900		94905		94910		94915		94919		94924		94929		94934		
890	94939		94944		94949		94954		94959		94963		94968		94973		94978		94983		4
891	94988		94993		94998		95002		95007		95012		95017		95022		95027		95032		
892	95036		95041		95046		95051		95056		95061		95066		95071		95075		95080		
893	95085		95090		95095		95100		95105		95109		95114		95119		95124		95129		
894	95134		95139		95143		95148		95153		95158		95163		95168		95173		95177		
895	95182		95187		95192		95197		95202		95207		95211		95216		95221		95226		1 2 3 4 5 6 7 8 9
896	95231		95236		95240		95245		95250		95255		95260		95265		95270		95274		
897	95279		95284		95289		95294		95299		95303		95308		95313		95318		95323		
898	95328		95332		95337		95342		95347		95352		95357		95361		95366		95371		
899	95376		95381		95386		95390		95395		95400		95405		95410		95415		95419		
900	95424		95429		95434		95439		95444		95448		95453		95458		95463		95468		
No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	

Logarithms of Numbers

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9000-9500

No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	Prop. parts
900	95424		95429		95434		95439		95444		95448		95453		95458		95463		95468		
901	95472		95477		95482		95487		95492		95497		95501		95506		95511		95516		5
902	95521		95525		95530		95535		95540		95545		95550		95554		95559		95564		
903	95569		95574		95578		95583		95588		95593		95598		95602		95607		95612		1
904	95617		95622		95626		95631		95636		95641		95646		95650		95655		95660		2
905	95665		95670		95674		95679		95684		95689		95694		95698		95703		95708		3
906	95713		95718		95722		95727		95732		95737		95742		95746		95751		95756		4
907	95761		95766		95770		95775		95780		95785		95789		95794		95799		95804		5
908	95809		95813		95818		95823		95828		95832		95837		95842		95847		95852		6
909	95856		95861		95866		95871		95875		95880		95885		95890		95895		95899		7
910	95904		95909		95914		95918		95923		95928		95933		95938		95942		95947		8
911	95952		95957		95961		95966		95971		95976		95980		95985		95990		95995		9
912	95999		96004		96009		96014		96019		96023		96028		96033		96038		96042		
913	96047		96052		96057		96061		96066		96071		96076		96080		96085		96090		
914	96095		96099		96104		96109		96114		96118		96123		96128		96133		96137		
915	96142		96147		96152		96156		96161		96166		96171		96175		96180		96185		
916	96190		96194		96199		96204		96209		96213		96218		96223		96227		96232		
917	96237		96242		96246		96251		96256		96261		96265		96270		96275		96280		
918	96284		96289		96294		96298		96303		96308		96313		96317		96322		96327		
919	96332		96336		96341		96346		96350		96355		96360		96365		96369		96374		
920	96379		96384		96388		96393		96398		96402		96407		96412		96417		96421		
921	96426		96431		96435		96440		96445		96450		96454		96459		96464		96468		
922	96473		96478		96483		96487		96492		96497		96501		96506		96511		96515		
923	96520		96525		96530		96534		96539		96544		96548		96553		96558		96562		
924	96567		96572		96577		96581		96586		96591		96595		96600		96605		96609		
925	96614		96619		96624		96628		96633		96638		96642		96647		96652		96656		
926	96661		96666		96670		96675		96680		96685		96689		96694		96699		96703		
927	96708		96713		96717		96722		96727		96731		96736		96741		96745		96750		
928	96755		96759		96764		96769		96774		96778		96783		96788		96792		96797		
929	96802		96806		96811		96816		96820		96825		96830		96834		96839		96844		
930	96848		96853		96858		96862		96867		96872		96876		96881		96886		96890		
931	96895		96900		96904		96909		96914		96918		96923		96928		96932		96937		
932	96942		96946		96951		96956		96960		96965		96970		96974		96979		96984		
933	96988		96993		96997		97002		97007		97011		97016		97021		97025		97030		
934	97035		97039		97044		97049		97053		97058		97063		97067		97072		97077		
935	97081		97086		97090		97095		97100		97104		97109		97114		97118		97123		
936	97128		97132		97137		97142		97146		97151		97155		97160		97165		97169		
937	97174		97179		97183		97188		97192		97197		97202		97206		97211		97216		
938	97220		97225		97230		97234		97239		97243		97248		97253		97257		97262		
939	97267		97271		97276		97280		97285		97290		97294		97299		97304		97308		
940	97313		97317		97322		97327		97331		97336		97340		97345		97350		97354		
941	97359		97364		97368		97373		97377		97382		97387		97391		97396		97400		
942	97405		97410		97414		97419		97424		97428		97433		97437		97442		97447		
943	97451		97456		97460		97465		97470		97474		97479		97483		97488		97493		
944	97497		97502		97506		97511		97516		97520		97525		97529		97534		97539		
945	97543		97548		97552		97557		97562		97566		97571		97575		97580		97585		
946	97589		97594		97598		97603		97607		97612		97617		97621		97626		97630		
947	97635		97640		97644		97649		97653		97658		97663		97667		97672		97676		
948	97681		97685		97690		97695		97699		97704		97708		97713		97717		97722		
949	97727		97731		97736		97740		97745		97749		97754		97759		97763		97768		
950	97772		97777		97782		97786		97791		97795		97800		97804		97809		97813		
No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	

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Logarithms of Numbers

9500-10000

No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	Prop. parts
950	97772		97777		97782		97786		97791		97795		97800		97804		97809		97813		
951	97818		97823		97827		97832		97836		97841		97845		97850		97855		97859		5
952	97864		97868		97873		97877		97882		97886		97891		97896		97900		97905		
953	97909		97914		97918		97923		97928		97932		97937		97941		97946		97950		0
954	97955		97959		97964		97968		97973		97978		97982		97987		97991		97996		1
955	98000		98005		98009		98014		98019		98023		98028		98032		98037		98041		2
956	98046		98050		98055		98059		98064		98068		98073		98078		98082		98087		3
957	98091		98096		98100		98105		98109		98114		98118		98123		98127		98132		4
958	98137		98141		98146		98150		98155		98159		98164		98168		98173		98177		5
959	98182		98186		98191		98195		98200		98204		98209		98214		98218		98223		6
960	98227		98232		98236		98241		98245		98250		98254		98259		98263		98268		7
961	98272		98277		98281		98286		98290		98295		98299		98304		98308		98313		8
962	98318		98322		98327		98331		98336		98340		98345		98349		98354		98358		9
963	98363		98367		98372		98376		98381		98385		98390		98394		98399		98403		
964	98408		98412		98417		98421		98426		98430		98435		98439		98444		98448		
965	98453		98457		98462		98466		98471		98475		98480		98484		98489		98493		
966	98498		98502		98507		98511		98516		98520		98525		98529		98534		98538		
967	98543		98547		98552		98556		98561		98565		98570		98574		98579		98583		
968	98588		98592		98597		98601		98605		98610		98614		98619		98623		98628		
969	98632		98637		98641		98646		98650		98655		98659		98664		98668		98673		
970	98677		98682		98686		98691		98695		98700		98704		98709		98713		98717		
971	98722		98726		98731		98735		98740		98744		98749		98753		98758		98762		
972	98767		98771		98776		98780		98784		98789		98793		98798		98802		98807		
973	98811		98816		98820		98825		98829		98834		98838		98843		98847		98851		
974	98856		98860		98865		98869		98874		98878		98883		98887		98892		98896		
975	98900		98905		98909		98914		98918		98923		98927		98932		98936		98941		
976	98945		98949		98954		98958		98963		98967		98972		98976		98981		98985		
977	98989		98994		98998		99003		99007		99012		99016		99021		99025		99029		
978	99034		99038		99043		99047		99052		99056		99061		99065		99069		99074		
979	99078		99083		99087		99092		99096		99100		99105		99109		99114		99118		
980	99123		99127		99131		99136		99140		99145		99149		99154		99158		99162		
981	99167		99171		99176		99180		99185		99189		99193		99198		99202		99207		
982	99211		99216		99220		99224		99229		99233		99238		99242		99247		99251		
983	99255		99260		99264		99269		99273		99277		99282		99286		99291		99295		
984	99300		99304		99308		99313		99317		99322		99326		99330		99335		99339		
985	99344		99348		99352		99357		99361		99366		99370		99374		99379		99383		
986	99388		99392		99396		99401		99405		99410		99414		99419		99423		99427		
987	99432		99436		99441		99445		99449		99454		99458		99463		99467		99471		
988	99476		99480		99484		99489		99493		99498		99502		99506		99511		99515		
989	99520		99524		99528		99533		99537		99542		99546		99550		99555		99559		
990	99564		99568		99572		99577		99581		99585		99590		99594		99599		99603		
991	99607		99612		99616		99621		99625		99629		99634		99638		99642		99647		4
992	99651		99656		99660		99664		99669		99673		99677		99682		99686		99691		
993	99695		99699		99704		99708		99712		99717		99721		99726		99730		99734		
994	99739		99743		99747		99752		99756		99760		99765		99769		99774		99778		1
995	99782		99787		99791		99795		99800		99804		99808		99813		99817		99822		2
996	99826		99830		99835		99839		99843		99848		99852		99856		99861		99865		3
997	99870		99874		99878		99883		99887		99891		99896		99900		99904		99909		4
998	99913		99917		99922		99926		99930		99935		99939		99943		99948		99952		5
999	99957		99961		99965		99970		99974		99978		99983		99987		99991		99996		6
1000	00000		00004		00009		00013		00017		00022		00026		00030		00035		00039		7
No.	0	d	1	d	2	d	3	d	4	d	5	d	6	d	7	d	8	d	9	d	

Meridional Parts

Lat.	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	Lat.
0	0.0	59.6	119.2	178.9	238.6	298.4	358.2	418.2	478.3	538.6	0
1	1.0	60.6	20.2	79.9	39.6	299.4	59.2	19.2	79.3	39.6	1
2	2.0	61.6	21.2	80.9	40.6	300.3	60.2	20.2	80.3	40.6	2
3	3.0	62.6	22.2	81.8	41.6	01.3	61.2	21.2	81.3	41.6	3
4	4.0	63.6	23.2	82.8	42.6	02.3	62.2	22.2	82.3	42.6	4
5	5.0	64.6	124.2	183.8	243.6	303.3	363.2	423.2	483.3	543.6	5
6	6.0	65.6	25.2	84.8	44.5	04.3	64.2	24.2	84.3	44.6	6
7	7.0	66.6	26.2	85.8	45.5	05.3	65.2	25.2	85.4	45.6	7
8	7.9	67.5	27.2	86.8	46.5	06.3	66.2	26.2	86.4	46.6	8
9	8.9	68.5	28.2	87.8	47.5	07.3	67.2	27.2	87.4	47.6	9
10	9.9	69.5	129.2	188.8	248.5	308.3	368.2	428.2	488.4	548.7	10
11	10.9	70.5	30.1	89.8	49.5	09.3	69.2	29.2	89.4	49.7	11
12	11.9	71.5	31.1	90.8	50.5	10.3	70.2	30.2	90.4	50.7	12
13	12.9	72.5	32.1	91.8	51.5	11.3	71.2	31.2	91.4	51.7	13
14	13.9	73.5	33.1	92.8	52.5	12.3	72.2	32.2	92.4	52.7	14
15	14.9	74.5	134.1	193.8	253.5	313.3	373.2	433.2	493.4	553.7	15
16	15.9	75.5	35.1	94.8	54.5	14.3	74.2	34.2	94.4	54.7	16
17	16.9	76.5	36.1	95.8	55.5	15.3	75.2	35.2	95.4	55.7	17
18	17.9	77.5	37.1	96.8	56.5	16.3	76.2	36.2	96.4	56.7	18
19	18.9	78.5	38.1	97.8	57.5	17.3	77.2	37.2	97.4	57.7	19
20	19.9	79.5	139.1	198.8	258.5	318.3	378.2	438.2	498.4	558.7	20
21	20.9	80.5	40.1	199.8	59.5	19.3	79.2	39.2	499.4	59.7	21
22	21.9	81.5	41.1	200.7	60.5	20.3	80.2	40.2	500.4	60.7	22
23	22.8	82.4	42.1	01.7	61.5	21.3	81.2	41.2	01.4	61.7	23
24	23.8	83.4	43.1	02.7	62.5	22.3	82.2	42.2	02.4	62.7	24
25	24.8	84.4	144.1	203.7	263.5	323.3	383.2	443.2	503.4	563.8	25
26	25.8	85.4	45.1	04.7	64.5	24.3	84.2	44.2	04.4	64.8	26
27	26.8	86.4	46.1	05.7	65.5	25.3	85.2	45.2	05.4	65.8	27
28	27.8	87.4	47.0	06.7	66.5	26.3	86.2	46.2	06.4	66.8	28
29	28.8	88.4	48.0	07.7	67.5	27.3	87.2	47.3	07.4	67.8	29
30	29.8	89.4	149.0	208.7	268.5	328.3	388.2	448.3	508.4	568.8	30
31	30.8	90.4	50.0	09.7	69.4	29.3	89.2	49.3	09.4	69.8	31
32	31.8	91.4	51.0	10.7	70.4	30.3	90.2	50.3	10.5	70.8	32
33	32.8	92.4	52.0	11.7	71.4	31.3	91.2	51.3	11.5	71.8	33
34	33.8	93.4	53.0	12.7	72.4	32.3	92.2	52.3	12.5	72.8	34
35	34.8	94.4	154.0	213.7	273.4	333.3	393.2	453.3	513.5	573.8	35
36	35.8	95.4	55.0	14.7	74.4	34.3	94.2	54.3	14.5	74.8	36
37	36.8	96.4	56.0	15.7	75.4	35.3	95.2	55.3	15.5	75.8	37
38	37.7	97.4	57.0	16.7	76.4	36.3	96.2	56.3	16.5	76.8	38
39	38.7	98.3	58.0	17.7	77.4	37.3	97.2	57.3	17.5	77.9	39
40	39.7	99.3	159.0	218.7	278.4	338.3	398.2	458.3	518.5	578.9	40
41	40.7	100.3	60.0	19.7	79.4	39.3	399.2	59.3	19.5	79.9	41
42	41.7	01.3	61.0	20.7	80.4	40.3	400.2	60.3	20.5	80.9	42
43	42.7	02.3	62.0	21.6	81.4	41.3	01.2	61.3	21.5	81.9	43
44	43.7	03.3	63.0	22.6	82.4	42.3	02.2	62.3	22.5	82.9	44
45	44.7	104.3	163.9	223.6	283.4	343.2	403.2	463.3	523.5	583.9	45
46	45.7	05.3	64.9	24.6	84.4	44.2	04.2	64.3	24.5	84.9	46
47	46.7	06.3	65.9	25.6	85.4	45.2	05.2	65.3	25.5	85.9	47
48	47.7	07.3	66.9	26.6	86.4	46.2	06.2	66.3	26.5	86.9	48
49	48.7	08.3	67.9	27.6	87.4	47.2	07.2	67.3	27.5	87.9	49
50	49.7	109.3	168.9	228.6	288.4	348.2	408.2	468.3	528.5	588.9	50
51	50.7	10.3	69.9	29.6	89.4	49.2	09.2	69.3	29.5	90.0	51
52	51.7	11.3	70.9	30.6	90.4	50.2	10.2	70.3	30.5	91.0	52
53	52.6	12.3	71.9	31.6	91.4	51.2	11.2	71.3	31.6	92.0	53
54	53.6	13.2	72.9	32.6	92.4	52.2	12.2	72.3	32.6	93.0	54
55	54.6	114.2	173.9	233.6	293.4	353.2	413.2	473.3	533.6	594.0	55
56	55.6	15.2	74.9	34.6	94.4	54.2	14.2	74.3	34.6	95.0	56
57	56.6	16.2	75.9	35.6	95.4	55.2	15.2	75.3	35.6	96.0	57
58	57.6	17.2	76.9	36.6	96.4	56.2	16.2	76.3	36.6	97.0	58
59	58.6	18.2	77.9	37.6	97.4	57.2	17.2	77.3	37.6	98.0	59
60	59.6	119.2	178.9	238.6	298.4	358.2	418.2	478.3	538.6	599.0	60
Lat.	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	Lat.

(23)

Meridional Parts

Lat.	10°	11°	12°	13°	14°	15°	16°	17°	18°	19°	Lat.
0	599.0	659.7	720.5	781.5	842.9	904.4	966.3	1028.5	1091.0	1153.9	0
1	600.0	60.7	21.5	82.6	43.9	05.5	67.3	29.5	92.1	55.0	1
2	01.0	61.7	22.5	83.6	44.9	06.5	68.4	30.6	93.1	56.0	2
3	02.1	62.7	23.5	84.6	45.9	07.5	69.4	31.6	94.2	57.1	3
4	03.1	63.7	24.5	85.6	47.0	08.6	70.4	32.7	95.2	58.1	4
5	604.1	664.7	725.6	786.6	848.0	909.6	971.5	1033.7	1096.3	1159.2	5
6	05.1	65.7	26.6	87.7	49.0	10.6	72.5	34.7	97.3	60.2	6
7	06.1	66.7	27.6	88.7	50.0	11.6	73.5	35.8	98.3	61.3	7
8	07.1	67.8	28.6	89.7	51.1	12.7	74.6	36.8	99.4	62.3	8
9	08.1	68.8	29.6	90.7	52.1	13.7	75.6	37.9	100.4	63.4	9
10	609.1	669.8	730.6	791.7	853.1	914.7	976.7	1038.9	1101.5	1164.4	10
11	10.1	70.8	31.7	92.8	54.1	15.8	77.7	39.9	02.5	65.5	11
12	11.1	71.8	32.7	93.8	55.1	16.8	78.7	41.0	03.6	66.5	12
13	12.1	72.8	33.7	94.8	56.2	17.8	79.8	42.0	04.6	67.6	13
14	13.2	73.8	34.7	95.8	57.2	18.8	80.8	43.1	05.7	68.6	14
15	614.2	674.8	735.7	796.8	858.2	919.9	981.8	1044.1	1106.7	1169.7	15
16	15.2	75.9	36.7	97.9	59.3	20.9	82.9	45.1	07.8	70.7	16
17	16.2	76.9	37.8	98.9	60.3	21.9	83.9	46.2	08.8	71.8	17
18	17.2	77.9	38.8	99.9	61.3	23.0	84.9	47.2	09.9	72.8	18
19	18.2	78.9	39.8	800.9	62.3	24.0	86.0	48.3	10.9	73.9	19
20	619.2	679.9	740.8	802.0	863.4	925.0	987.0	1049.3	1111.9	1175.0	20
21	20.2	80.9	41.8	03.0	64.4	26.1	88.0	50.3	13.0	76.0	21
22	21.2	81.9	42.8	04.0	65.4	27.1	89.1	51.4	14.0	77.1	22
23	22.2	82.9	43.9	05.0	66.4	28.1	90.1	52.4	15.1	78.1	23
24	23.3	84.0	44.9	06.0	67.5	29.2	91.1	53.5	16.1	79.2	24
25	624.3	685.0	745.9	807.1	868.5	930.2	992.2	1054.5	1117.2	1180.2	25
26	25.3	86.0	46.9	08.1	69.5	31.2	93.2	55.6	18.2	81.3	26
27	26.3	87.0	47.9	09.1	70.5	32.2	94.3	56.6	19.3	82.3	27
28	27.3	88.0	48.9	10.1	71.6	33.3	95.3	57.6	20.3	83.4	28
29	28.3	89.0	50.0	11.1	72.6	34.3	96.3	58.7	21.4	84.4	29
30	629.3	690.0	751.0	812.2	873.6	935.3	997.4	1059.7	1122.4	1185.5	30
31	30.3	91.1	52.0	13.2	74.6	36.4	98.4	60.8	23.5	86.5	31
32	31.3	92.1	53.0	14.2	75.7	37.4	99.4	61.8	24.5	87.6	32
33	32.3	93.1	54.0	15.2	76.7	38.4	100.5	62.8	25.6	88.7	33
34	33.4	94.1	55.1	16.3	77.7	39.5	01.5	63.9	26.6	89.7	34
35	634.4	695.1	756.1	817.3	878.7	940.5	1002.5	1064.9	1127.7	1190.8	35
36	35.4	96.1	57.1	18.3	79.8	41.5	03.6	66.0	28.7	91.8	36
37	36.4	97.1	58.1	19.3	80.8	42.6	04.6	67.0	29.8	92.9	37
38	37.4	98.2	59.1	20.3	81.8	43.6	05.7	68.1	30.8	93.9	38
39	38.4	99.2	60.1	21.4	82.9	44.6	06.7	69.1	31.9	95.0	39
40	639.4	700.2	761.2	822.4	883.9	945.7	1007.7	1070.1	1132.9	1196.0	40
41	40.4	01.2	62.2	23.4	84.9	46.7	08.8	71.2	34.0	97.1	41
42	41.4	02.2	63.2	24.4	85.9	47.7	09.8	72.2	35.0	98.2	42
43	42.5	03.2	64.2	25.5	87.0	48.7	10.8	73.3	36.1	99.2	43
44	43.5	04.2	65.2	26.5	88.0	49.8	11.9	74.3	37.1	100.3	44
45	644.5	705.3	766.3	827.5	889.0	950.8	1012.9	1075.4	1138.2	1201.3	45
46	45.5	06.3	67.3	28.5	90.0	51.8	14.0	76.4	39.2	02.4	46
47	46.5	07.3	68.3	29.5	91.1	52.9	15.0	77.4	40.3	03.4	47
48	47.5	08.3	69.3	30.6	92.1	53.9	16.0	78.5	41.3	04.5	48
49	48.5	09.3	70.3	31.6	93.1	54.9	17.1	79.5	42.4	05.5	49
50	649.5	710.3	771.4	832.6	894.2	956.0	1018.1	1080.6	1143.4	1206.6	50
51	50.5	11.3	72.4	33.6	95.2	57.0	19.2	81.6	44.5	07.7	51
52	51.6	12.4	73.4	34.7	96.2	58.0	20.2	82.7	45.5	08.7	52
53	52.6	13.4	74.4	35.7	97.2	59.1	21.2	83.7	46.6	09.8	53
54	53.6	14.4	75.4	36.7	98.3	60.1	22.3	84.8	47.6	10.8	54
55	654.6	715.4	776.4	837.7	899.3	961.1	1023.3	1085.8	1148.7	1211.9	55
56	55.6	16.4	77.5	38.8	90.3	62.2	24.3	86.8	49.7	12.9	56
57	56.6	17.4	78.5	39.8	91.4	63.2	25.4	87.9	50.8	14.0	57
58	57.6	18.5	79.5	40.8	92.4	64.2	26.4	88.9	51.8	15.1	58
59	58.6	19.5	80.5	41.8	93.4	65.3	27.5	90.0	52.9	16.1	59
60	659.7	720.5	781.5	842.9	904.4	966.3	1028.5	1091.0	1153.9	1217.2	60
Lat.	10°	11°	12°	13°	14°	15°	16°	17°	18°	19°	Lat.

Meridional Parts

Lat.	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°	Lat.
0	1217.2	1280.9	1345.0	1409.5	1474.6	1540.2	1606.3	1672.9	1740.2	1808.1	0
1	18.2	81.9	46.0	10.6	75.7	41.3	07.4	74.1	41.4	09.3	1
2	19.3	83.0	47.1	11.7	76.8	42.4	08.5	75.2	42.5	10.4	2
3	20.4	84.1	48.2	12.8	77.9	43.4	09.6	76.3	43.6	11.6	3
4	21.4	85.1	49.3	13.9	78.9	44.5	10.7	77.4	44.7	12.7	4
5	1222.5	1286.2	1350.3	1414.9	1480.0	1545.6	1611.8	1678.5	1745.9	1813.8	5
6	23.5	87.2	51.4	16.0	81.1	46.7	12.9	79.6	47.0	15.0	6
7	24.6	88.3	52.5	17.1	82.2	47.8	14.0	80.8	48.1	16.1	7
8	25.6	89.4	53.5	18.2	83.3	48.9	15.1	81.9	49.3	17.3	8
9	26.7	90.4	54.6	19.3	84.4	50.0	16.2	83.0	50.4	18.4	9
10	1227.8	1291.5	1355.7	1420.3	1485.5	1551.1	1617.3	1684.1	1751.5	1819.5	10
11	28.8	92.6	56.8	21.4	86.6	52.2	18.4	85.2	52.6	20.7	11
12	29.9	93.6	57.8	22.5	87.7	53.3	19.6	86.4	53.8	21.8	12
13	30.9	94.7	58.9	23.6	88.8	54.4	20.7	87.5	54.9	23.0	13
14	32.0	95.8	60.0	24.7	89.8	55.5	21.8	88.6	56.0	24.1	14
15	1233.1	1296.8	1361.1	1425.8	1490.9	1556.6	1622.9	1689.7	1757.2	1825.2	15
16	34.1	97.9	62.1	26.8	92.0	57.7	24.0	90.8	58.3	26.4	16
17	35.2	1299.0	63.2	27.9	93.1	58.8	25.1	91.9	59.4	27.5	17
18	36.2	1300.0	64.3	29.0	94.2	59.9	26.2	93.1	60.5	28.7	18
19	37.3	01.1	65.4	30.1	95.3	61.0	27.3	94.2	61.7	29.8	19
20	1238.4	1302.2	1366.4	1431.2	1496.4	1562.1	1628.4	1695.3	1762.8	1830.9	20
21	39.4	03.2	67.5	32.2	97.5	63.2	29.5	96.4	63.9	32.1	21
22	40.5	04.3	68.6	33.3	98.6	64.3	30.6	97.5	65.1	33.2	22
23	41.5	05.4	69.7	34.4	1499.7	65.4	31.8	98.7	66.2	34.4	23
24	42.6	06.4	70.7	35.5	1500.8	66.5	32.9	1699.8	67.3	35.5	24
25	1243.7	1307.5	1371.8	1436.6	1501.8	1567.6	1634.0	1700.9	1768.5	1836.6	25
26	44.7	08.6	72.9	37.7	02.9	68.7	35.1	02.0	69.6	37.8	26
27	45.8	09.6	74.0	38.7	04.0	69.8	36.2	03.1	70.7	38.9	27
28	46.8	10.7	75.0	39.8	05.1	70.9	37.3	04.3	71.8	40.1	28
29	47.9	11.8	76.1	40.9	06.2	72.0	38.4	05.4	73.0	41.2	29
30	1249.0	1312.9	1377.2	1442.0	1507.3	1573.1	1639.5	1706.5	1774.1	1842.4	30
31	50.0	13.9	78.3	43.1	08.4	74.2	40.6	07.6	75.2	43.5	31
32	51.1	15.0	79.3	44.2	09.5	75.3	41.8	08.8	76.4	44.6	32
33	52.1	16.1	80.4	45.3	10.6	76.4	42.9	09.9	77.5	45.8	33
34	53.2	17.1	81.5	46.3	11.7	77.6	44.0	11.0	78.6	46.9	34
35	1254.3	1318.2	1382.6	1447.4	1512.8	1578.7	1645.1	1712.1	1779.8	1848.1	35
36	55.3	19.3	83.7	48.5	13.9	79.8	46.2	13.2	80.9	49.2	36
37	56.4	20.3	84.7	49.6	15.0	80.9	47.3	14.4	82.0	50.4	37
38	57.5	21.4	85.8	50.7	16.1	82.0	48.4	15.5	83.2	51.5	38
39	58.5	22.5	86.9	51.8	17.1	83.1	49.5	16.6	84.3	52.7	39
40	1259.6	1323.5	1388.0	1452.8	1518.2	1584.2	1650.7	1717.7	1785.4	1853.8	40
41	60.6	24.6	89.0	53.9	19.3	85.3	51.8	18.9	86.6	54.9	41
42	61.7	25.7	90.1	55.0	20.4	86.4	52.9	20.0	87.7	56.1	42
43	62.8	26.8	91.2	56.1	21.5	87.5	54.0	21.1	88.8	57.2	43
44	63.8	27.8	92.3	57.2	22.6	88.6	55.1	22.2	90.0	58.4	44
45	1264.9	1328.9	1393.3	1458.3	1523.7	1589.7	1656.2	1723.4	1791.1	1859.5	45
46	66.0	30.0	94.4	59.4	24.8	90.8	57.3	24.5	92.2	60.7	46
47	67.0	31.0	95.5	60.5	25.9	91.9	58.5	25.6	93.4	61.8	47
48	68.1	32.1	96.6	61.5	27.0	93.0	59.6	26.7	94.5	63.0	48
49	69.1	33.2	97.7	62.6	28.1	94.1	60.7	27.9	95.6	64.1	49
50	1270.2	1334.2	1398.7	1463.7	1529.2	1595.2	1661.8	1729.0	1796.8	1865.3	50
51	71.3	35.3	1399.8	64.8	30.3	96.3	62.9	30.1	97.9	66.4	51
52	72.3	36.4	1400.9	65.9	31.4	97.4	64.0	31.2	1799.1	67.5	52
53	73.4	37.5	02.0	67.0	32.5	98.5	65.1	32.4	1800.2	68.7	53
54	74.5	38.5	03.1	68.1	33.6	1599.6	66.3	33.5	01.3	69.8	54
55	1275.5	1339.6	1404.1	1469.1	1534.7	1600.7	1667.4	1734.6	1802.5	1871.0	55
56	76.6	40.7	05.2	70.2	35.8	01.8	68.5	35.7	03.6	72.1	56
57	77.7	41.7	06.3	71.3	36.9	02.9	69.6	36.9	04.7	73.3	57
58	78.7	42.8	07.4	72.4	38.0	04.1	70.7	38.0	05.9	74.4	58
59	79.8	43.9	08.5	73.5	39.1	05.2	71.8	39.1	07.0	75.6	59
60	1280.9	1345.0	1409.5	1474.6	1540.2	1606.3	1672.9	1740.2	1808.1	1876.7	60
Lat.	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°	Lat.

23

Meridional Parts

Lat.	30°	31°	32°	33°	34°	35°	36°	37°	38°	39°	Lat.
0	1876.7	1946.0	2016.0	2086.8	2158.5	2230.9	2304.3	2378.6	2453.9	2530.3	0
1	77.9	47.2	17.2	88.0	59.7	32.1	05.5	79.9	55.2	31.6	1
2	79.0	48.3	18.4	89.2	60.9	33.4	06.8	81.1	56.5	32.8	2
3	80.2	49.5	19.6	90.4	62.1	34.6	08.0	82.4	57.7	34.1	3
4	81.3	50.7	20.7	91.6	63.3	35.8	09.2	83.6	59.0	35.4	4
5	1882.5	1951.8	2021.9	2092.8	2164.5	2237.0	2310.5	2384.9	2460.2	2536.7	5
6	83.6	53.0	23.1	94.0	65.7	38.2	11.7	86.1	61.5	38.0	6
7	84.8	54.2	24.3	95.2	66.9	39.4	12.9	87.3	62.8	39.3	7
8	85.9	55.3	25.4	96.3	68.1	40.7	14.2	88.6	64.0	40.5	8
9	87.1	56.5	26.6	97.5	69.3	41.9	15.4	89.8	65.3	41.8	9
10	1888.2	1957.6	2027.8	2098.7	2170.5	2243.1	2316.6	2391.1	2466.6	2543.1	10
11	89.4	58.8	29.0	2099.9	71.7	44.3	17.9	92.3	67.8	44.4	11
12	90.5	60.0	30.1	2101.1	72.9	45.5	19.1	93.6	69.1	45.7	12
13	91.7	61.1	31.3	02.3	74.1	46.7	20.3	94.8	70.4	47.0	13
14	92.8	62.3	32.5	03.5	75.3	48.0	21.6	96.1	71.6	48.2	14
15	1894.0	1963.5	2033.7	2104.7	2176.5	2249.2	2322.8	2397.3	2472.9	2549.5	15
16	95.1	64.6	34.8	05.9	77.7	50.4	24.0	98.6	74.2	50.8	16
17	96.3	65.8	35.0	07.1	78.9	51.6	25.3	2399.8	75.4	52.1	17
18	97.4	66.9	37.2	08.2	80.1	52.8	26.5	2401.1	76.7	53.4	18
19	98.6	68.1	38.4	09.4	81.3	54.1	27.7	02.4	78.0	54.7	19
20	1899.8	1969.3	2039.6	2110.6	2182.5	2255.3	2329.0	2403.6	2479.3	2556.0	20
21	1900.9	70.4	40.7	11.8	83.7	56.5	30.2	04.9	80.5	57.3	21
22	02.1	71.6	41.9	13.0	84.9	57.7	31.4	06.1	81.8	58.5	22
23	03.2	72.8	43.1	14.2	86.1	58.9	32.7	07.4	83.1	59.8	23
24	04.4	73.9	44.3	15.4	87.3	60.1	33.9	08.6	84.3	61.1	24
25	1905.5	1975.1	2045.4	2116.6	2188.5	2261.1	2335.1	2409.9	2485.6	2562.4	25
26	06.7	76.3	46.6	17.8	89.8	62.6	36.4	11.1	86.9	63.7	26
27	07.8	77.4	47.8	19.0	91.0	63.8	37.6	12.4	88.1	65.0	27
28	09.0	78.6	49.0	20.2	92.2	65.1	38.9	13.6	89.4	66.3	28
29	10.1	79.8	50.2	21.4	93.4	66.3	40.1	14.9	90.7	67.6	29
30	1911.3	1980.9	2051.3	2122.5	2194.6	2267.5	2341.3	2416.1	2492.0	2568.9	30
31	12.4	82.1	52.5	23.7	95.8	68.7	42.6	17.4	93.2	70.1	31
32	13.6	83.3	53.7	24.9	97.0	69.9	43.8	18.7	94.5	71.4	32
33	14.8	84.4	54.9	26.1	98.2	71.2	45.1	19.9	95.8	72.7	33
34	15.9	85.6	56.1	27.3	2199.4	72.4	46.3	21.2	97.1	74.0	34
35	1917.1	1986.8	2057.2	2128.5	2200.6	2273.6	2347.5	2422.4	2498.3	2575.3	35
36	18.2	87.9	58.4	29.7	01.8	74.8	48.8	23.7	2499.6	76.6	36
37	19.4	89.1	59.6	30.9	03.0	76.1	50.0	24.9	2500.9	77.9	37
38	20.5	90.3	60.8	32.1	04.3	77.3	51.3	26.2	02.2	79.2	38
39	21.7	91.5	62.0	33.3	05.5	78.5	52.5	27.4	03.4	80.5	39
40	1922.8	1992.6	2063.2	2134.5	2206.7	2279.7	2353.7	2428.7	2504.7	2581.8	40
41	24.0	93.8	64.3	35.7	07.9	81.0	55.0	30.0	06.0	83.1	41
42	25.2	95.0	65.5	36.9	09.1	82.2	56.2	31.2	07.3	84.4	42
43	26.3	96.1	66.7	38.1	10.3	83.4	57.5	32.5	08.5	85.7	43
44	27.5	97.3	67.9	39.3	11.5	84.6	58.7	33.7	09.8	87.0	44
45	1928.6	1998.5	2069.1	2140.5	2212.7	2285.9	2359.9	2435.0	2511.1	2588.3	45
46	29.8	1999.6	70.3	41.7	13.9	87.1	61.2	36.3	12.4	89.5	46
47	30.9	2000.8	71.4	42.9	15.2	88.3	62.4	37.5	13.6	90.8	47
48	32.1	02.0	72.6	44.1	16.4	89.6	63.7	38.8	14.9	92.1	48
49	33.3	03.2	73.8	45.3	17.6	90.8	64.9	40.0	16.2	93.4	49
50	1934.4	2004.3	2075.0	2146.5	2218.8	2292.0	2366.2	2441.3	2517.5	2594.7	50
51	35.6	05.5	76.2	47.7	20.0	93.2	67.4	42.6	18.8	96.0	51
52	36.7	06.7	77.4	48.9	21.2	94.5	68.7	43.8	20.0	97.3	52
53	37.9	07.8	78.5	50.1	22.4	95.7	69.9	45.1	21.3	98.6	53
54	39.1	09.0	79.7	51.3	23.6	96.9	71.1	46.3	22.6	2599.9	54
55	1940.2	2010.2	2080.9	2152.5	2224.9	2298.2	2372.4	2447.6	2523.9	2601.2	55
56	41.4	11.4	82.1	53.7	26.1	2299.4	73.6	48.9	25.1	02.5	56
57	42.5	12.5	83.3	54.9	27.3	2300.6	74.9	50.1	26.4	03.8	57
58	43.7	13.7	84.5	56.1	28.5	01.8	76.1	51.4	27.7	05.1	58
59	44.9	14.9	85.7	57.3	29.7	03.1	77.4	52.7	29.0	06.4	59
60	1946.0	2016.0	2086.8	2158.5	2230.9	2304.3	2378.6	2453.9	2530.3	2607.7	60
Lat.	30°	31°	32°	33°	34°	35°	36°	37°	38°	39°	Lat.

Meridional Parts

Lat.	40°	41°	42°	43°	44°	45°	46°	47°	48°	49°	Lat.
0	2607.7	2686.3	2766.1	2847.2	2929.6	3013.5	3098.8	3185.7	3274.2	3364.5	0
1	09.0	87.6	67.5	48.6	31.0	14.9	3100.2	87.1	75.7	66.0	1
2	10.3	89.0	68.8	49.9	32.4	16.3	01.7	88.6	77.2	67.5	2
3	11.6	90.3	70.1	51.3	33.8	17.7	03.1	90.1	78.7	69.1	3
4	12.9	91.6	71.5	52.7	35.2	19.1	04.5	91.5	80.2	70.6	4
5	2614.2	2692.9	2772.8	2854.0	2936.6	3020.5	3106.0	3193.0	3281.7	3372.1	5
6	15.5	94.2	74.2	55.4	38.0	21.9	07.4	94.5	83.2	73.6	6
7	16.8	95.6	75.5	56.8	39.3	23.3	08.8	95.9	84.7	75.1	7
8	18.1	96.9	76.9	58.1	40.7	24.8	10.3	97.4	86.1	76.7	8
9	19.4	98.2	78.2	59.5	42.1	26.2	11.7	3198.8	87.6	78.2	9
10	2620.7	2699.5	2779.5	2860.9	2943.5	3027.6	3113.2	3200.3	3289.1	3379.7	10
11	22.0	2700.9	80.9	62.2	44.9	29.0	14.6	01.8	90.6	81.2	11
12	23.3	02.2	82.2	63.6	46.3	30.4	16.0	03.2	92.1	82.8	12
13	24.6	03.5	83.6	65.0	47.7	31.8	17.5	04.7	93.6	84.3	13
14	26.0	04.8	84.9	66.3	49.1	33.2	18.9	06.2	95.1	85.8	14
15	2627.3	2706.2	2786.3	2867.7	2950.5	3034.7	3120.4	3207.7	3296.6	3387.4	15
16	28.6	07.5	87.6	69.1	51.8	36.1	21.8	09.1	98.1	88.9	16
17	29.9	08.8	89.0	70.4	53.2	37.5	23.2	10.6	3299.6	90.4	17
18	31.2	10.1	90.3	71.8	54.6	38.9	24.7	12.1	3301.1	91.9	18
19	32.5	11.5	91.7	73.2	56.0	40.3	26.1	13.5	02.6	93.5	19
20	2633.8	2712.8	2793.0	2874.5	2957.4	3041.7	3127.6	3215.0	3304.1	3395.0	20
21	35.1	14.1	94.4	75.9	58.8	43.2	29.0	16.5	05.6	96.5	21
22	36.4	15.4	95.7	77.3	60.2	44.6	30.5	17.9	07.1	98.1	22
23	37.7	16.8	97.1	78.6	61.6	46.0	31.9	19.4	08.6	3399.6	23
24	39.0	18.1	98.4	80.0	63.0	47.4	33.4	20.9	10.1	3401.1	24
25	2640.3	2719.4	2799.8	2881.4	2964.4	3048.8	3134.8	3222.4	3311.6	3402.2	25
26	41.6	20.7	2801.1	82.8	65.8	50.3	36.2	23.8	13.1	04.2	26
27	42.9	22.1	02.5	84.1	67.2	51.7	37.7	25.3	14.6	05.7	27
28	44.3	23.4	03.8	85.5	68.6	53.1	39.1	26.8	16.1	07.3	28
29	45.6	24.7	05.2	86.9	70.0	54.5	40.6	28.3	17.6	08.8	29
30	2646.9	2726.1	2806.5	2888.2	2971.4	3055.9	3142.0	3229.7	3319.1	3410.3	30
31	48.2	27.4	07.9	89.6	72.8	57.4	43.5	31.2	20.6	11.9	31
32	49.5	28.7	09.2	91.0	74.2	58.8	44.9	32.7	22.1	13.4	32
33	50.8	30.1	10.6	92.4	75.6	60.2	46.4	34.2	23.6	14.9	33
34	52.1	31.4	11.9	93.7	77.0	61.6	47.8	35.6	25.2	16.5	34
35	2653.4	2732.7	2813.3	2895.1	2978.4	3063.1	3149.3	3237.1	3326.7	3418.0	35
36	54.7	34.1	14.6	96.5	79.8	64.5	50.7	38.6	28.2	19.5	36
37	56.0	35.4	16.0	97.9	81.2	65.9	52.2	40.1	29.7	21.1	37
38	57.4	36.7	17.3	2899.3	82.6	67.3	53.6	41.6	31.2	22.6	38
39	58.7	38.1	18.7	2900.6	84.0	68.8	55.1	43.0	32.7	24.2	39
40	2660.0	2739.4	2820.0	2902.0	2985.4	3070.2	3156.5	3244.5	3334.2	3425.7	40
41	61.3	40.7	21.4	03.4	86.8	71.6	58.0	46.0	35.7	27.2	41
42	62.6	42.1	22.7	04.8	88.2	73.0	59.4	47.5	37.2	28.8	42
43	63.9	43.4	24.1	06.1	89.6	74.5	60.9	49.0	38.7	30.3	43
44	65.2	44.7	25.5	07.5	91.0	75.9	62.3	50.4	40.2	31.9	44
45	2666.6	2746.1	2826.8	2908.9	2992.4	3077.3	3163.8	3251.9	3341.8	3433.4	45
46	67.9	47.4	28.2	10.3	93.8	78.7	65.3	53.4	43.3	35.0	46
47	69.2	48.7	29.5	11.7	95.2	80.2	66.7	54.9	44.8	36.5	47
48	70.5	50.1	30.9	13.0	96.6	81.6	68.2	56.4	46.3	38.0	48
49	71.8	51.4	32.2	14.4	98.0	83.0	69.6	57.9	47.8	39.6	49
50	2673.1	2752.7	2833.6	2915.8	2999.4	3084.5	3171.1	3259.3	3349.3	3441.1	50
51	74.5	54.1	35.0	17.2	3000.8	85.9	72.5	60.8	50.8	42.7	51
52	75.8	55.4	36.3	18.6	02.2	87.3	74.0	62.3	52.4	44.2	52
53	77.1	56.8	37.7	19.9	03.6	88.8	75.5	63.8	53.9	45.8	53
54	78.4	58.1	39.0	21.3	05.0	90.2	76.9	65.3	55.4	47.3	54
55	2679.7	2759.4	2840.4	2922.7	3006.4	3091.6	3178.4	3266.8	3356.9	3448.9	55
56	81.0	60.8	41.8	24.1	07.8	93.1	79.8	68.3	58.4	50.4	56
57	82.4	62.1	43.1	25.5	09.2	94.5	81.3	69.7	59.9	52.0	57
58	83.7	63.4	44.5	26.9	10.6	95.9	82.8	71.2	61.5	53.5	58
59	85.0	64.8	45.8	28.2	12.1	97.4	84.2	72.7	63.0	55.1	59
60	2686.3	2766.1	2847.2	2929.6	3013.5	3098.8	3185.7	3274.2	3364.5	3456.6	60
Lat.	40°	41°	42°	43°	44°	45°	46°	47°	48°	49°	Lat.

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Meridional Parts

Lat.	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Lat.
0	3456.6	3550.7	3646.8	3745.2	3845.8	3948.9	4054.6	4163.1	4274.5	4389.2	0
1	58.2	52.3	48.5	46.8	47.5	50.6	56.4	64.9	76.4	91.1	1
2	59.7	53.9	50.1	48.5	49.2	52.4	58.2	66.7	78.3	93.0	2
3	61.3	55.5	51.7	50.1	50.9	54.1	59.9	68.6	80.2	95.0	3
4	62.8	57.0	53.3	51.8	52.6	55.8	61.7	70.4	82.1	96.9	4
5	3464.4	3558.6	3654.9	3753.4	3854.3	3957.6	4063.5	4172.2	4284.0	4398.9	5
6	65.9	60.2	56.6	55.1	56.0	59.3	65.3	74.1	85.8	100.8	6
7	67.5	61.8	58.2	56.8	57.7	61.1	67.1	75.9	87.7	102.8	7
8	69.1	63.4	59.8	58.4	59.4	62.8	68.9	77.8	89.6	104.7	8
9	70.6	65.0	61.4	60.1	61.1	64.6	70.7	79.6	91.5	106.6	9
10	3472.2	3566.6	3663.1	3761.8	3862.8	3966.3	4072.5	4181.4	4293.4	4408.6	10
11	73.7	68.2	64.7	63.4	64.5	68.1	74.3	83.3	95.3	110.5	11
12	75.3	69.8	66.3	65.1	66.2	69.8	76.1	85.1	97.2	112.5	12
13	76.8	71.3	67.9	66.8	67.9	71.6	77.8	87.0	99.1	114.4	13
14	78.4	72.9	69.6	68.4	69.6	73.3	79.6	88.8	101.0	116.4	14
15	3480.0	3574.5	3671.2	3770.1	3871.3	3975.1	4081.4	4190.7	4302.9	4418.3	15
16	81.5	76.1	72.8	71.8	73.0	76.8	83.2	92.5	104.8	120.3	16
17	83.1	77.7	74.5	73.4	74.7	78.6	85.0	94.3	106.7	122.2	17
18	84.6	79.3	76.1	75.1	76.4	80.3	86.8	96.2	108.6	124.2	18
19	86.2	80.9	77.7	76.8	78.2	82.1	88.6	98.0	110.5	126.2	19
20	3487.8	3582.5	3679.4	3778.4	3879.9	3983.8	4090.4	4199.9	4312.4	4428.1	20
21	89.3	84.1	81.0	80.1	81.6	85.6	92.2	101.7	114.3	130.1	21
22	90.9	85.7	82.6	81.8	83.3	87.3	94.0	103.6	116.2	132.0	22
23	92.4	87.3	84.3	83.4	85.0	89.1	95.8	105.4	118.1	134.0	23
24	94.0	88.9	85.9	85.1	86.7	90.8	97.6	107.3	120.0	135.9	24
25	3495.6	3590.5	3687.5	3786.8	3888.4	3992.6	4099.4	4209.1	4321.9	4437.9	25
26	97.1	92.1	89.2	88.5	90.1	94.4	101.2	111.0	123.8	139.9	26
27	3498.7	93.7	90.8	90.1	91.9	96.1	103.0	112.9	125.7	141.8	27
28	3500.3	95.3	92.4	91.8	93.6	97.9	104.9	114.7	127.6	143.8	28
29	01.8	96.9	94.1	93.5	95.3	99.6	106.7	116.6	129.5	145.8	29
30	3503.4	3598.5	3695.7	3795.2	3897.0	4001.4	4108.5	4218.4	4331.4	4447.7	30
31	05.0	3600.1	97.3	96.8	3898.7	03.2	10.3	20.3	33.3	49.7	31
32	06.5	01.7	3699.0	3798.5	3900.5	04.9	12.1	22.1	35.3	51.7	32
33	08.1	03.3	3700.6	3800.2	02.2	06.7	13.9	24.0	37.2	53.6	33
34	09.7	04.9	02.3	01.9	03.9	08.4	15.7	25.9	39.1	55.6	34
35	3511.3	3606.5	3703.9	3803.6	3905.6	4010.2	4117.5	4227.7	4341.0	4457.6	35
36	12.8	08.1	05.6	05.2	07.3	12.0	19.3	29.6	42.9	59.6	36
37	14.4	09.7	07.2	06.9	09.1	13.7	21.1	31.4	44.8	61.5	37
38	16.0	11.3	08.8	08.6	10.8	15.5	23.0	33.3	46.7	63.5	38
39	17.5	12.9	10.5	10.3	12.5	17.3	24.8	35.2	48.7	65.5	39
40	3519.1	3614.6	3712.1	3812.0	3914.2	4019.0	4126.6	4237.0	4350.6	4467.5	40
41	20.7	16.2	13.8	13.7	16.0	20.8	28.4	38.9	52.5	69.4	41
42	22.3	17.8	15.4	15.3	17.7	22.6	30.2	40.8	54.4	71.4	42
43	23.8	19.4	17.1	17.0	19.4	24.4	32.0	42.6	56.3	73.4	43
44	25.4	21.0	18.7	18.7	21.1	26.1	33.9	44.5	58.3	75.4	44
45	3527.0	3622.6	3720.4	3820.4	3922.9	4027.9	4135.7	4246.4	4360.2	4477.3	45
46	28.6	24.2	22.0	22.1	24.6	29.7	37.5	48.2	62.1	79.3	46
47	30.1	25.8	23.7	23.8	26.3	31.5	39.3	50.1	64.0	81.3	47
48	31.7	27.4	25.3	25.5	28.1	33.2	41.1	52.0	66.0	83.3	48
49	33.3	29.0	27.0	27.2	29.8	35.0	43.0	53.9	67.9	85.3	49
50	3534.9	3630.7	3728.6	3828.8	3931.5	4036.8	4144.8	4255.7	4369.8	4487.3	50
51	36.5	32.3	30.3	30.5	33.2	38.6	46.6	57.6	71.8	89.3	51
52	38.0	33.9	31.9	32.2	35.0	40.3	48.4	59.5	73.7	91.2	52
53	39.6	35.5	33.6	33.9	36.7	42.1	50.3	61.4	75.6	93.2	53
54	41.2	37.1	35.2	35.6	38.5	43.9	52.1	63.2	77.5	95.2	54
55	3542.8	3638.7	3736.9	3837.3	3940.2	4045.7	4153.9	4265.1	4379.5	4497.2	55
56	44.4	40.4	38.5	39.0	41.9	47.5	55.8	67.0	81.4	99.2	56
57	45.9	42.0	40.2	40.7	43.7	49.2	57.6	68.9	83.4	101.2	57
58	47.5	43.6	41.8	42.4	45.4	51.0	59.4	70.8	85.3	103.2	58
59	49.1	45.2	43.5	44.1	47.1	52.8	61.2	72.6	87.2	105.2	59
60	3550.7	3646.8	3745.2	3845.8	3948.9	4054.6	4163.1	4274.5	4389.2	4507.2	60
Lat.	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Lat.

Meridional Parts

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Lat.	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	Lat.
0	4507.2	4628.8	4754.4	4884.2	5018.5	5157.7	5302.2	5452.5	5609.2	5772.8	0
1	09.2	30.9	56.5	86.4	20.7	60.0	04.7	55.1	11.9	75.6	1
2	11.2	33.0	58.7	88.6	23.0	62.4	07.1	57.7	14.5	78.4	2
3	13.2	35.0	60.8	90.8	25.3	64.8	09.6	60.2	17.2	81.2	3
4	15.2	37.1	62.9	93.0	27.6	67.1	12.1	62.8	19.9	84.0	4
5	4517.2	4639.1	4765.0	4895.2	5029.9	5169.5	5314.5	5465.4	5622.6	5786.8	5
6	19.2	41.2	67.2	97.4	32.2	71.9	17.0	67.9	25.2	89.6	6
7	21.2	43.3	69.3	4899.6	34.5	74.3	19.4	70.5	27.9	92.4	7
8	23.2	45.3	71.5	4901.8	36.7	76.6	21.9	73.1	30.6	95.2	8
9	25.2	47.4	73.6	04.0	39.0	79.0	24.4	75.6	33.3	5798.0	9
10	4527.2	4649.5	4775.7	4906.2	5041.3	5181.4	5326.9	5478.2	5636.0	5800.8	10
11	29.2	51.6	77.9	08.4	43.6	83.8	29.3	80.8	38.7	03.6	11
12	31.2	53.6	80.0	10.7	45.9	86.1	31.8	83.4	41.3	06.4	12
13	33.2	55.7	82.1	12.9	48.2	88.5	34.3	85.9	44.0	09.2	13
14	35.2	57.8	84.3	15.1	50.5	90.9	36.8	88.5	46.7	12.0	14
15	4537.2	4659.9	4786.4	4917.3	5052.8	5193.3	5339.2	5491.1	5649.4	5814.9	15
16	39.3	61.9	88.6	19.5	55.1	95.7	41.7	93.7	52.1	17.7	16
17	41.3	64.0	90.7	21.7	57.4	5198.1	44.2	96.3	54.8	20.5	17
18	43.3	66.1	92.9	24.0	59.7	5200.5	46.7	5498.9	57.5	23.3	18
19	45.3	68.2	95.0	26.2	62.0	02.9	49.2	5501.4	60.2	26.1	19
20	4547.3	4670.2	4797.2	4928.4	5064.3	5205.2	5351.7	5504.0	5662.9	5829.0	20
21	49.3	72.3	4799.3	30.6	66.6	07.6	54.1	06.6	65.6	31.8	21
22	51.4	74.4	4801.5	32.9	68.9	10.0	56.6	09.2	68.3	34.6	22
23	53.4	76.5	03.6	35.1	71.2	12.4	59.1	11.8	71.1	37.5	23
24	55.4	78.6	05.8	37.3	73.5	14.8	61.6	14.4	73.8	40.3	24
25	4557.4	4680.7	4807.9	4939.6	5075.9	5217.2	5364.1	5517.0	5676.5	5843.2	25
26	59.4	82.8	10.1	41.8	78.2	19.6	66.6	19.6	79.2	46.0	26
27	61.5	84.8	12.3	44.0	80.5	22.0	69.1	22.2	81.9	48.8	27
28	63.5	86.9	14.4	46.3	82.8	24.4	71.6	24.8	84.6	51.7	28
29	65.5	89.0	16.6	48.5	85.1	26.8	74.1	27.4	87.4	54.5	29
30	4567.5	4691.1	4818.7	4950.7	5087.4	5229.3	5376.6	5530.0	5690.1	5857.4	30
31	69.6	93.2	20.9	53.0	89.8	31.7	79.1	32.7	92.8	60.3	31
32	71.6	95.3	23.1	55.2	92.1	34.1	81.6	35.3	95.5	63.1	32
33	73.6	97.4	25.2	57.4	94.4	36.5	84.1	37.9	5698.3	66.0	33
34	75.7	4699.5	27.4	59.7	96.7	38.9	86.7	40.5	5701.0	68.8	34
35	4577.7	4701.6	4829.6	4961.9	5099.1	5241.3	5389.2	5543.1	5703.7	5871.7	35
36	79.7	03.7	31.7	64.2	5101.4	43.7	91.7	45.7	06.5	74.6	36
37	81.8	05.8	33.9	66.4	03.7	46.2	94.2	48.4	09.2	77.4	37
38	83.8	07.9	36.1	68.7	06.0	48.6	96.7	51.0	12.0	80.3	38
39	85.8	10.0	38.3	70.9	08.4	51.0	5399.2	53.6	14.7	83.2	39
40	4587.9	4712.1	4840.4	4973.2	5110.7	5253.4	5401.8	5556.2	5717.5	5886.0	40
41	89.9	14.2	42.6	75.4	13.0	55.8	04.3	58.9	20.2	88.9	41
42	91.9	16.3	44.8	77.7	15.4	58.3	06.8	61.5	22.9	91.8	42
43	94.0	18.4	47.0	79.9	17.7	60.7	09.3	64.1	25.7	94.7	43
44	96.0	20.5	49.1	82.2	20.1	63.1	11.9	66.8	28.5	5897.6	44
45	4598.1	4722.6	4851.3	4984.4	5122.4	5265.6	5414.4	5569.4	5731.2	5900.4	45
46	4600.1	24.7	53.5	86.7	24.7	68.0	16.9	72.1	34.0	03.3	46
47	02.2	26.8	55.7	89.0	27.1	70.4	19.5	74.7	36.7	06.2	47
48	04.2	29.0	57.9	91.2	29.4	72.9	22.0	77.3	39.5	09.1	48
49	06.3	31.1	60.0	93.5	31.8	75.3	24.5	80.0	42.3	12.0	49
50	4608.3	4733.2	4862.2	4995.8	5134.1	5277.7	5427.1	5582.6	5745.0	5914.9	50
51	10.3	35.3	64.4	4998.0	36.5	80.2	29.6	85.3	47.8	17.8	51
52	12.4	37.4	66.6	5000.3	38.8	82.6	32.1	87.9	50.6	20.7	52
53	14.4	39.5	68.8	02.6	41.2	85.1	34.7	90.6	53.3	23.6	53
54	16.5	41.7	71.0	04.8	43.5	87.5	37.2	93.2	56.1	26.5	54
55	4618.6	4743.8	4873.2	5007.1	5145.9	5290.0	5439.8	5595.9	5758.9	5929.4	55
56	20.6	45.9	75.4	09.4	48.2	92.4	42.3	5598.5	61.7	32.3	56
57	22.7	48.0	77.6	11.6	50.6	94.9	44.9	5601.2	64.4	35.3	57
58	24.7	50.1	79.8	13.9	53.0	97.3	47.4	03.9	67.2	38.2	58
59	26.8	52.3	82.0	16.2	55.3	5299.8	50.0	06.5	70.0	41.1	59
60	4628.8	4754.4	4884.2	5018.5	5157.7	5302.2	5452.5	5609.2	5772.8	5944.0	60
Lat.	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	Lat.

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Meridional Parts

Lat.	70°	71°	72°	73°	74°	75°	76°	77°	78°	79°	Lat.
0	5944.0	6123.7	6312.7	6512.1	6723.3	6947.8	7187.4	7444.5	7721.8	8022.8	0
1	46.9	26.7	15.9	15.5	27.0	51.7	91.6	48.9	26.6	28.1	1
2	49.9	29.8	19.1	19.0	30.6	55.5	95.7	53.4	31.4	33.3	2
3	52.8	32.9	22.4	22.4	34.2	59.4	7199.9	57.8	36.2	38.6	3
4	55.7	36.0	25.6	25.8	37.9	63.3	7204.0	62.3	41.0	43.8	4
5	5958.6	6139.0	6328.9	6529.3	6741.5	6967.2	7208.2	7466.8	7745.9	8049.1	5
6	61.6	42.1	32.1	32.7	45.2	71.1	12.3	71.2	50.7	54.4	6
7	64.5	45.2	35.4	36.1	48.8	75.0	16.5	75.7	55.6	59.7	7
8	67.5	48.3	38.6	39.6	52.5	78.8	20.7	80.2	60.4	65.0	8
9	70.4	51.4	41.9	43.0	56.1	82.7	24.8	84.7	65.3	70.3	9
10	5973.3	6154.5	6345.1	6546.5	6759.8	6986.6	7229.0	7489.2	7770.2	8075.6	10
11	76.3	57.6	48.4	49.9	63.4	90.6	33.2	93.7	75.0	80.9	11
12	79.2	60.7	51.7	53.4	67.1	94.5	37.4	7498.2	79.9	86.3	12
13	82.2	63.8	55.0	56.8	70.8	99.8.4	41.6	7502.7	84.8	91.6	13
14	85.1	66.9	58.2	60.3	74.5	7002.3	45.8	07.3	89.7	8096.9	14
15	5988.1	6170.0	6361.5	6563.8	6778.1	7006.2	7250.0	7511.8	7794.6	8102.3	15
16	91.1	78.1	64.8	67.2	81.8	10.2	54.2	10.3	7799.5	07.7	16
17	94.0	76.2	68.1	70.7	85.5	14.1	58.4	20.9	7804.5	13.0	17
18	97.0	79.3	71.4	74.2	89.2	18.0	62.6	25.4	09.4	18.4	18
19	5999.9	82.4	74.6	77.7	92.9	22.0	66.8	29.9	14.3	23.8	19
20	6002.9	6185.6	6377.9	6581.2	6796.6	7025.9	7271.1	7534.5	7819.3	8129.2	20
21	05.9	88.7	81.2	84.6	6800.3	29.9	75.3	39.1	24.2	34.6	21
22	08.9	91.8	84.5	88.1	04.0	33.8	79.5	43.6	29.2	40.0	22
23	11.8	94.9	87.8	91.6	07.7	37.8	83.8	48.2	34.1	45.4	23
24	14.8	6198.1	91.1	95.1	11.4	41.7	88.0	52.8	39.1	50.9	24
25	6017.8	6201.2	6394.4	6598.6	6815.2	7045.7	7292.3	7557.4	7844.1	8156.3	25
26	20.8	04.3	6397.7	6602.1	18.9	49.7	7296.5	62.0	49.1	61.8	26
27	23.8	07.5	6401.1	05.6	22.6	53.6	7300.8	66.6	54.0	67.2	27
28	26.7	10.6	04.4	09.1	26.3	57.6	05.1	71.2	59.0	72.7	28
29	29.7	13.8	07.7	12.7	30.1	61.6	09.3	75.8	64.0	78.2	29
30	6032.7	6216.9	6411.0	6616.2	6833.8	7065.6	7313.6	7580.4	7869.1	8183.6	30
31	35.7	20.1	14.3	19.7	37.5	69.6	17.9	85.0	74.1	89.1	31
32	38.7	23.2	17.7	23.2	41.3	73.6	22.2	89.6	79.1	8194.6	32
33	41.7	26.4	21.0	26.7	45.0	77.6	26.5	94.3	84.1	8200.1	33
34	44.7	29.5	24.3	30.3	48.8	81.6	30.8	7598.9	89.2	05.7	34
35	6047.7	6232.7	6427.7	6633.8	6852.6	7085.6	7335.1	7603.6	7894.2	8211.2	35
36	50.7	35.9	31.0	37.3	56.3	89.6	39.4	08.2	7899.3	16.7	36
37	53.7	39.0	34.4	40.9	60.1	93.7	43.7	12.9	7904.3	22.3	37
38	56.8	42.2	37.7	44.4	63.9	7097.7	48.0	17.5	09.4	27.8	38
39	59.8	45.4	41.0	48.0	67.6	7101.7	52.4	22.2	14.5	33.4	39
40	6062.8	6248.6	6444.4	6651.5	6871.4	7105.8	7356.7	7626.9	7919.6	8238.9	40
41	65.8	51.7	47.8	55.1	75.2	09.8	61.0	31.6	24.7	44.5	41
42	68.8	54.9	51.1	58.6	79.0	13.8	65.4	36.3	29.7	50.1	42
43	71.8	58.1	54.5	62.2	82.8	17.9	69.7	41.0	34.9	55.7	43
44	74.9	61.3	57.8	65.8	86.6	21.9	74.1	45.7	40.0	61.3	44
45	6077.9	6264.5	6461.2	6669.3	6890.4	7126.0	7378.4	7650.4	7945.1	8266.9	45
46	80.9	67.7	64.6	72.9	94.2	30.1	82.8	55.1	50.2	72.5	46
47	84.0	70.9	68.0	76.5	6898.0	34.1	87.2	59.8	55.4	78.2	47
48	87.0	74.1	71.3	80.1	6901.8	38.2	91.6	64.5	60.5	83.8	48
49	90.0	77.3	74.7	83.7	05.6	42.3	7395.9	69.3	65.6	89.5	49
50	6093.1	6280.5	6478.1	6687.3	6909.4	7146.4	7400.3	7674.0	7970.8	8295.1	50
51	96.1	83.7	81.5	90.8	13.2	50.4	04.7	78.7	76.0	8300.8	51
52	6099.2	86.9	84.9	94.4	17.1	54.5	09.1	83.5	81.1	06.5	52
53	6102.2	90.1	88.3	6698.0	20.9	58.6	13.5	88.3	86.3	12.2	53
54	05.3	93.3	91.7	6701.6	24.7	62.7	17.9	93.0	91.5	17.9	54
55	6108.3	6296.5	6495.1	6705.2	6928.6	7166.8	7422.3	7697.8	7996.7	8323.6	55
56	11.4	6299.8	6498.5	08.9	32.4	71.0	28.8	7702.6	8001.9	29.3	56
57	14.5	6303.0	6501.9	12.5	36.2	75.1	31.2	07.4	07.1	35.0	57
58	17.5	06.2	05.3	16.1	40.1	79.2	35.6	12.2	12.4	40.7	58
59	20.6	09.4	08.7	19.7	44.0	83.3	40.0	17.0	17.6	46.5	59
60	6128.7	6312.7	6512.1	6723.3	6947.8	7187.4	7444.5	7721.8	8022.8	8352.2	60
Lat.	70°	71°	72°	73°	74°	75°	76°	77°	78°	79°	Lat.

TRUE AMPLITUDES

Lat	Declination δ														
	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°
2	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0
4	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0
6	1.0	2.0	3.0	4.0	5.0	6.0	7.1	8.1	9.1	10.1	11.1	12.1	13.1	14.1	15.1
8	1.0	2.0	3.0	4.1	5.1	6.1	7.1	8.1	9.1	10.1	11.1	12.1	13.1	14.1	15.2
10	1.0	2.0	3.1	4.1	5.1	6.1	7.1	8.1	9.2	10.2	11.2	12.2	13.2	14.2	15.3
12	1.0	2.1	3.1	4.1	5.1	6.1	7.2	8.2	9.2	10.2	11.3	12.3	13.3	14.3	15.4
14	1.0	2.1	3.1	4.1	5.2	6.2	7.2	8.3	9.3	10.3	11.3	12.4	13.4	14.4	15.5
16	1.1	2.1	3.1	4.2	5.2	6.2	7.3	8.3	9.4	10.4	11.5	12.5	13.5	14.6	15.6
18	1.1	2.1	3.2	4.2	5.3	6.3	7.4	8.4	9.5	10.5	11.6	12.6	13.7	14.7	15.8
20	1.1	2.1	3.2	4.3	5.3	6.4	7.5	8.5	9.6	10.7	11.7	12.8	13.9	14.9	15.9
22	1.1	2.2	3.2	4.3	5.4	6.5	7.6	8.6	9.7	10.8	11.9	13.0	14.1	15.1	16.2
24	1.1	2.2	3.3	4.4	5.5	6.6	7.7	8.8	9.9	11.0	12.1	13.2	14.3	15.4	16.5
26	1.1	2.2	3.4	4.5	5.6	6.7	7.8	8.9	10.0	11.2	12.3	13.4	14.5	15.6	16.8
28	1.1	2.3	3.4	4.5	5.7	6.8	7.9	9.1	10.2	11.4	12.5	13.6	14.8	15.9	17.1
30	1.2	2.3	3.5	4.6	5.8	6.9	8.1	9.3	10.4	11.6	12.7	13.9	15.1	16.2	17.4
31	1.2	2.3	3.5	4.7	5.8	7.0	8.2	9.4	10.5	11.7	12.9	14.0	15.2	16.4	17.6
32	1.2	2.4	3.6	4.7	5.9	7.1	8.3	9.5	10.6	11.8	13.0	14.2	15.4	16.6	17.8
33	1.2	2.4	3.6	4.8	6.0	7.2	8.4	9.6	10.8	12.0	13.2	14.4	15.6	16.8	18.0
34	1.2	2.4	3.6	4.8	6.0	7.3	8.5	9.7	10.9	12.1	13.3	14.5	15.8	17.0	18.2
36	1.2	2.5	3.7	4.9	6.1	7.3	8.6	9.8	11.0	12.2	13.5	14.7	16.0	17.2	18.4
38	1.2	2.5	3.7	5.0	6.2	7.4	8.7	9.9	11.2	12.4	13.7	14.9	16.2	17.4	18.7
37	1.3	2.5	3.8	5.0	6.3	7.5	8.8	10.0	11.3	12.6	13.8	15.1	16.4	17.6	18.9
38	1.3	2.5	3.8	5.1	6.4	7.6	8.9	10.2	11.4	12.7	14.0	15.3	16.6	17.9	19.2
39	1.3	2.6	3.9	5.2	6.4	7.7	9.0	10.3	11.6	12.9	14.2	15.5	16.8	18.1	19.5
40	1.3	2.6	3.9	5.2	6.5	7.9	9.2	10.5	11.8	13.1	14.4	15.8	17.1	18.4	19.8
41	1.3	2.7	4.0	5.3	6.6	8.0	9.3	10.6	12.0	13.3	14.7	16.0	17.4	18.7	20.1
42	1.4	2.7	4.0	5.4	6.7	8.1	9.4	10.8	12.2	13.5	14.9	16.3	17.6	19.0	20.4
43	1.4	2.7	4.1	5.5	6.9	8.2	9.6	11.0	12.4	13.7	15.1	16.5	17.9	19.3	20.7
44	1.4	2.8	4.2	5.6	7.0	8.4	9.8	11.2	12.6	14.0	15.4	16.8	18.2	19.7	21.1
45	1.4	2.8	4.3	5.7	7.1	8.5	9.9	11.4	12.8	14.2	15.7	17.1	18.6	20.0	21.5
46	1.4	2.9	4.3	5.8	7.2	8.7	10.1	11.6	13.0	14.5	16.0	17.4	18.9	20.4	21.9
47	1.5	2.9	4.4	5.9	7.4	8.8	10.3	11.8	13.3	14.8	16.3	17.8	19.3	20.8	22.3
48	1.5	3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.1	16.6	18.1	19.7	21.2	22.8
49	1.5	3.1	4.6	6.1	7.6	9.2	10.7	12.3	13.8	15.4	16.9	18.5	20.1	21.6	23.2
50	1.6	3.1	4.7	6.2	7.8	9.4	10.9	12.5	14.1	15.7	17.3	18.9	20.5	22.1	23.8
50.1	1.6	3.1	4.7	6.3	7.9	9.5	11.0	12.6	14.2	15.8	17.5	19.1	20.7	22.4	24.0
51	1.6	3.1	4.8	6.4	8.0	9.6	11.2	12.8	14.4	16.0	17.7	19.3	21.0	22.6	24.3
51.1	1.6	3.2	4.8	6.4	8.0	9.7	11.3	12.9	14.6	16.2	17.8	19.5	21.2	22.9	24.6
52	1.6	3.3	4.9	6.5	8.1	9.8	11.4	13.1	14.7	16.4	18.1	19.7	21.4	23.2	24.9
52.1	1.6	3.3	4.9	6.6	8.2	9.9	11.5	13.2	14.9	16.6	18.3	20.0	21.7	23.4	25.2
53	1.7	3.3	5.0	6.7	8.3	10.0	11.7	13.4	15.1	16.8	18.5	20.2	22.0	23.7	25.5
53.1	1.7	3.4	5.0	6.7	8.4	10.1	11.8	13.5	15.2	17.0	18.7	20.5	22.2	24.0	25.8
54	1.7	3.4	5.1	6.8	8.5	10.3	12.0	13.7	15.4	17.2	19.0	20.7	22.5	24.3	26.1
54.1	1.7	3.4	5.2	6.9	8.6	10.4	12.2	13.9	15.6	17.4	19.2	21.0	22.8	24.6	26.5
55	1.8	3.5	5.2	7.0	8.7	10.5	12.3	14.1	15.8	17.6	19.4	21.3	23.1	25.0	26.8
55.1	1.8	3.5	5.3	7.1	8.9	10.6	12.4	14.2	16.0	17.9	19.7	21.5	23.4	25.3	27.2
56	1.8	3.6	5.4	7.2	9.0	10.8	12.6	14.4	16.3	18.1	20.0	21.8	23.7	25.6	27.6
56.1	1.8	3.6	5.4	7.3	9.1	10.9	12.8	14.6	16.5	18.3	20.2	22.1	24.1	26.0	28.0
57	1.8	3.7	5.5	7.4	9.2	11.1	12.9	14.8	16.7	18.6	20.5	22.4	24.4	26.4	28.4
57.1	1.9	3.7	5.6	7.5	9.3	11.2	13.1	15.0	16.9	18.9	20.8	22.8	24.8	26.8	28.9
58	1.9	3.8	5.7	7.6	9.5	11.4	13.3	15.2	17.2	19.1	21.1	23.1	25.1	27.2	29.2
58.1	1.9	3.8	5.7	7.7	9.6	11.5	13.5	15.4	17.4	19.4	21.4	23.4	25.5	27.6	29.7
59	2.0	3.9	5.8	7.8	9.8	11.7	13.7	15.7	17.7	19.7	21.8	23.8	25.9	28.0	30.2
59.1	2.0	3.9	5.9	7.9	9.9	11.9	13.9	15.9	18.0	20.0	22.1	24.2	26.3	28.5	30.7
60	2.0	4.0	6.0	8.0	10.0	12.1	14.1	16.2	18.2	20.3	22.4	24.6	26.7	28.9	31.2
60.1	2.0	4.1	6.1	8.1	10.2	12.3	14.3	16.4	18.5	20.6	22.8	25.0	27.2	29.4	31.7
61	2.1	4.1	6.2	8.3	10.4	12.5	14.6	16.7	18.8	21.0	23.2	25.4	27.7	29.9	32.3
61.1	2.1	4.2	6.3	8.4	10.5	12.7	14.8	17.0	19.1	21.3	23.6	25.8	28.1	30.5	32.8
62	2.1	4.3	6.4	8.6	10.7	12.9	15.1	17.3	19.5	21.7	24.0	26.3	28.6	31.0	33.5
62.1	2.2	4.3	6.5	8.7	10.9	13.1	15.3	17.5	19.8	22.1	24.4	26.8	29.2	31.6	34.1

TRUE AMPLITUDES

Lat	Declination														
	16°	17°	18°	19°	20°	20½°	21°	21½°	22°	22½°	23°	23½°	24°	24½°	25°
2	16-0	17-0	18-0	19-0	20-0	20-5	21-0	21-5	22-0	22-5	23-0	23-5	24-0	24-5	25-0
4	16-0	17-1	18-1	19-1	20-1	20-6	21-1	21-6	22-1	22-6	23-1	23-6	24-1	24-6	25-1
6	16-1	17-1	18-1	19-1	20-1	20-6	21-1	21-6	22-1	22-6	23-1	23-6	24-1	24-6	25-1
8	16-2	17-2	18-2	19-2	20-2	20-7	21-2	21-7	22-2	22-7	23-2	23-7	24-3	24-8	25-3
10	16-3	17-3	18-3	19-3	20-3	20-8	21-4	21-8	22-4	22-9	23-4	23-9	24-4	24-9	25-4
12	16-4	17-4	18-4	19-4	20-5	21-0	21-5	22-0	22-5	23-0	23-6	24-1	24-6	25-1	25-6
14	16-5	17-5	18-6	19-6	20-6	21-2	21-7	22-2	22-7	23-2	23-8	24-3	24-8	25-3	25-8
16	16-7	17-7	18-8	19-8	20-9	21-4	21-9	22-4	22-9	23-5	24-0	24-5	25-0	25-6	26-1
18	16-9	17-9	19-0	20-0	21-1	21-6	22-1	22-7	23-2	23-7	24-3	24-8	25-3	25-9	26-4
20	17-1	18-1	19-2	20-3	21-4	21-9	22-4	23-0	23-5	24-0	24-6	25-1	25-7	26-2	26-7
22	17-3	18-4	19-5	20-6	21-7	22-2	22-7	23-3	23-8	24-4	24-9	25-5	26-0	26-6	27-1
24	17-6	18-7	19-8	20-9	22-0	22-5	23-1	23-7	24-2	24-8	25-3	25-9	26-4	27-0	27-6
26	17-9	19-0	20-1	21-2	22-4	22-9	23-5	24-1	24-6	25-2	25-8	26-3	26-9	27-5	28-0
28	18-2	19-3	20-5	21-6	22-8	23-4	24-0	24-5	25-1	25-7	26-3	26-8	27-4	28-0	28-6
30	18-6	19-7	20-9	22-1	23-3	23-9	24-5	25-0	25-6	26-2	26-8	27-4	28-0	28-6	29-2
31	18-8	20-0	21-1	22-3	23-5	24-1	24-7	25-3	25-9	26-5	27-1	27-7	28-3	28-9	29-5
32	19-0	20-2	21-4	22-6	23-8	24-4	25-0	25-6	26-2	26-8	27-4	28-0	28-7	29-3	29-9
33	19-2	20-4	21-6	22-9	24-1	24-7	25-3	25-9	26-5	27-1	27-8	28-4	29-0	29-6	30-3
34	19-4	20-6	21-9	23-1	24-4	25-0	25-6	26-2	26-9	27-5	28-1	28-7	29-4	29-9	30-7
35	19-7	20-9	22-2	23-4	24-7	25-3	26-0	26-6	27-2	27-9	28-5	29-1	29-8	30-4	31-1
36	19-9	21-2	22-5	23-7	25-0	25-7	26-3	26-9	27-6	28-2	28-9	29-5	30-2	30-8	31-5
37	20-2	21-5	22-8	24-1	25-4	26-0	26-7	27-3	28-0	28-6	29-3	30-0	30-6	31-3	31-9
38	20-5	21-8	23-1	24-4	25-7	26-4	27-1	27-7	28-4	29-1	29-7	30-4	31-1	31-8	32-4
39	20-8	22-1	23-4	24-8	26-1	26-8	27-5	28-1	28-8	29-5	30-2	30-9	31-6	32-3	32-9
40	21-1	22-4	23-8	25-2	26-5	27-2	27-9	28-6	29-3	30-0	30-7	31-4	32-1	32-8	33-5
41	21-4	22-8	24-2	25-6	27-0	27-6	28-4	29-1	29-8	30-5	31-2	31-9	32-6	33-3	34-1
42	21-8	23-2	24-6	26-0	27-4	28-1	28-8	29-6	30-3	31-0	31-7	32-5	33-2	33-9	34-7
43	22-1	23-6	25-0	26-4	27-9	28-6	29-3	30-1	30-8	31-6	32-3	33-0	33-8	34-5	35-3
44	22-5	24-0	25-4	26-9	28-4	29-1	29-9	30-6	31-4	32-1	32-9	33-7	34-4	35-2	36-0
45	23-0	24-4	25-9	27-4	28-9	29-7	30-5	31-3	32-0	32-8	33-6	34-3	35-1	35-9	36-7
46	23-4	24-9	26-4	28-0	29-5	30-3	31-1	31-8	32-6	33-4	34-2	35-0	35-8	36-7	37-5
47	23-8	25-4	27-0	28-5	30-1	30-9	31-7	32-5	33-3	34-1	35-0	35-8	36-6	37-5	38-3
48	24-3	25-9	27-5	29-1	30-7	31-6	32-4	33-2	34-1	34-9	35-7	36-6	37-4	38-3	39-2
49	24-9	26-5	28-1	29-8	31-4	32-3	33-1	34-0	34-8	35-7	36-6	37-4	38-3	39-2	40-1
50	25-4	27-1	28-7	30-4	32-2	33-0	33-9	34-8	35-6	36-5	37-4	38-3	39-3	40-2	41-1
50½	25-7	27-4	29-1	30-8	32-5	33-4	34-3	35-2	36-1	37-0	37-9	38-8	39-8	40-7	41-6
51	26-0	27-7	29-4	31-2	32-9	33-8	34-7	35-6	36-5	37-5	38-4	39-3	40-3	41-2	42-2
51½	26-3	28-0	29-8	31-5	33-3	34-2	35-1	36-1	37-0	37-9	38-9	39-8	40-8	41-8	42-8
52	26-6	28-4	30-1	31-9	33-8	34-7	35-6	36-5	37-5	38-4	39-4	40-4	41-4	42-3	43-4
52½	26-9	28-7	30-5	32-3	34-2	35-1	36-1	37-0	38-0	38-9	39-9	40-9	41-9	42-9	44-0
53	27-3	29-1	30-9	32-8	34-6	35-6	36-6	37-5	38-5	39-5	40-5	41-5	42-5	43-6	44-6
53½	27-6	29-4	31-3	33-2	35-1	36-1	37-0	38-0	39-0	40-0	41-1	42-1	43-1	44-2	45-3
54	28-0	29-8	31-7	33-6	35-6	36-6	37-6	38-6	39-6	40-6	41-7	42-7	43-8	44-9	46-0
54½	28-3	30-2	32-2	34-1	36-1	37-1	38-1	39-1	40-1	41-2	42-3	43-4	44-5	45-6	46-7
55	28-7	30-7	32-6	34-5	36-6	37-6	38-7	39-7	40-8	41-9	42-9	44-0	45-2	46-3	47-5
55½	29-1	31-1	33-1	35-1	37-1	38-2	39-3	40-3	41-4	42-5	43-6	44-7	45-9	46-9	48-3
56	29-5	31-5	33-6	35-6	37-7	38-8	39-9	41-0	42-1	43-2	44-3	45-5	46-7	47-9	49-1
56½	30-0	32-0	34-0	36-1	38-3	39-4	40-5	41-6	42-6	43-9	45-1	46-3	47-5	48-7	50-0
57	30-4	32-5	34-6	36-7	38-9	40-0	41-2	42-3	43-5	44-6	45-9	47-1	48-3	49-6	50-9
57½	30-9	33-0	35-1	37-3	39-5	40-7	41-8	43-0	44-2	45-4	46-7	47-9	49-2	50-5	51-9
58	31-3	33-5	35-7	37-9	40-2	41-4	42-6	43-8	45-0	46-2	47-5	48-8	50-1	51-5	52-9
58½	31-8	34-0	36-3	38-5	40-9	42-1	43-3	44-5	45-8	47-1	48-4	49-7	51-1	52-5	54-0
59	32-4	34-6	36-9	39-2	41-6	42-8	44-1	45-4	46-7	48-0	49-4	50-7	52-2	53-6	55-1
59½	32-9	35-2	37-5	39-9	42-4	43-6	44-9	46-2	47-5	48-9	50-3	51-8	53-3	54-8	56-4
60	33-5	35-8	38-2	40-6	43-2	44-5	45-8	47-1	48-5	49-9	51-4	52-9	54-4	56-0	57-7
60½	34-0	36-4	38-8	41-4	44-0	45-3	46-7	48-1	49-5	51-0	52-5	54-1	55-7	57-4	59-1
61	34-7	37-1	39-6	42-2	44-9	46-3	47-7	49-1	50-6	52-1	53-7	55-3	57-0	58-8	60-6
61½	35-3	37-8	40-4	43-0	45-8	47-2	48-7	50-2	51-7	53-3	55-0	56-7	58-5	60-4	62-3
62	36-0	38-5	41-2	43-9	46-8	48-2	49-8	51-3	52-9	54-6	56-3	58-1	60-0	62-0	64-2
62½	36-7	39-3	42-0	44-8	47-9	49-3	50-9	52-5	54-2	56-0	57-8	59-7	61-7	63-9	66-2

TRUE AMPLITUDES								
Lat.	Declination							
	25½°	26°	26½°	27°	27½°	28°	28½°	29°
2	25.5	26.0	26.5	27.0	27.5	28.0	28.5	29.0
4	25.6	26.1	26.6	27.1	27.6	28.1	28.6	29.1
6	25.7	26.2	26.7	27.2	27.7	28.2	28.7	29.2
8	25.8	26.3	26.8	27.3	27.8	28.3	28.8	29.3
10	25.9	26.4	26.9	27.5	28.0	28.5	29.0	29.5
12	26.1	26.6	27.1	27.7	28.2	28.7	29.2	29.7
14	26.3	26.9	27.4	27.9	28.4	28.9	29.5	30.0
16	26.6	27.1	27.7	28.2	28.7	29.2	29.8	30.3
18	26.9	27.5	28.0	28.5	29.0	29.6	30.1	30.7
20	27.3	27.8	28.3	28.9	29.4	30.0	30.5	31.1
22	27.7	28.2	28.8	29.3	29.9	30.4	31.0	31.5
24	28.1	28.7	29.2	29.8	30.4	30.9	31.5	32.1
26	28.6	29.2	29.8	30.3	30.9	31.5	32.1	32.6
28	29.2	29.8	30.4	30.9	31.5	32.1	32.7	33.3
30	29.8	30.4	31.0	31.6	32.2	32.8	33.4	34.1
31	30.1	30.8	31.4	32.0	32.6	33.2	33.8	34.5
32	30.5	31.1	31.7	32.4	33.0	33.6	34.2	34.9
33	30.9	31.5	32.1	32.8	33.4	34.0	34.7	35.3
34	31.3	31.9	32.6	33.2	33.8	34.5	35.1	35.8
35	31.7	32.4	33.0	33.7	34.3	35.0	35.6	36.3
36	32.2	32.8	33.5	34.1	34.8	35.5	36.1	36.8
37	32.6	33.3	34.0	34.6	35.3	36.0	36.7	37.4
38	33.1	33.8	34.5	35.2	35.9	36.6	37.3	38.0
39	33.6	34.3	35.0	35.8	36.5	37.2	37.9	38.6
40	34.2	34.9	35.6	36.4	37.1	37.8	38.5	39.3
41	34.8	35.5	36.2	37.0	37.7	38.5	39.2	40.0
42	35.4	36.2	36.9	37.7	38.4	39.2	39.9	40.7
43	36.1	36.8	37.6	38.4	39.2	39.9	40.7	41.5
44	36.8	37.5	38.3	39.2	39.9	40.7	41.6	42.4
45	37.5	38.3	39.1	39.9	40.8	41.6	42.4	43.3
46	38.3	39.1	40.0	40.8	41.7	42.5	43.4	44.3
47	39.1	40.0	40.9	41.7	42.6	43.5	44.4	45.3
48	40.0	40.9	41.8	42.7	43.6	44.5	45.5	46.4
49	41.0	41.9	42.9	43.8	44.7	45.7	46.7	47.7
50	42.0	43.0	44.0	44.9	45.9	46.9	47.9	49.0
50½	42.6	43.6	44.5	45.5	46.5	47.6	48.6	49.7
51	43.2	44.2	45.2	46.2	47.2	48.2	49.3	50.4
51½	43.8	44.8	45.8	46.8	47.9	49.0	50.0	51.2
52	44.4	45.4	46.4	47.5	48.6	49.7	50.8	52.0
52½	45.0	46.0	47.1	48.2	49.3	50.5	51.6	52.8
53	45.7	46.7	47.9	49.0	50.1	51.3	52.5	53.7
53½	46.4	47.5	48.6	49.8	50.9	52.1	53.3	54.6
54	47.1	48.2	49.4	50.6	51.8	53.0	54.3	55.6
54½	47.8	49.0	50.2	51.4	52.7	53.9	55.3	56.6
55	48.6	49.8	51.1	52.3	53.6	54.9	56.3	57.7
55½	49.5	50.7	52.0	53.3	54.6	56.0	57.4	58.9
56	50.3	51.6	52.9	54.3	55.7	57.1	58.6	60.1
56½	51.3	52.6	53.9	55.4	56.8	58.3	59.8	61.4
57	52.2	53.6	55.0	56.5	58.0	59.6	61.2	62.9
57½	53.2	54.7	56.1	57.7	59.2	60.7	62.6	65.0
58	54.3	55.8	57.4	58.9	60.6	62.4	64.2	66.2
58½	55.5	57.0	58.6	60.3	62.1	64.0	66.0	68.1
59	56.7	58.3	60.0	61.8	63.7	65.7	67.9	70.3
59½	58.0	59.7	61.5	63.4	65.5	67.7	70.1	72.8
60	59.4	61.2	63.2	65.2	67.4	69.9	72.6	75.8
60½	61.0	62.9	65.0	67.2	69.7	72.4	75.7	79.9
61	62.6	64.7	67.0	69.4	72.3	75.5	79.8	90.0
61½	64.5	66.7	69.3	72.1	75.4	79.7	90.0	---
62	66.2	69.0	71.9	75.2	79.6	90.0	---	---
62½	68.8	71.7	75.1	79.5	90.0	---	---	---

Amplitude Corrections								
Lat.	Declination							
	0°	5°	10°	15°	20°	25°		
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
10	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
15	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
20	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3
25	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
30	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
35	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5
40	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.7
42	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7
44	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7
46	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8
48	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9
50	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.0
52	0.8	0.9	0.9	0.9	1.0	1.0	1.1	1.1
54	0.9	0.9	1.0	1.0	1.1	1.1	1.3	1.3
56	0.9	0.9	1.0	1.0	1.2	1.2	1.5	1.5
58	1.0	1.0	1.1	1.2	1.3	1.3	1.7	1.7
60	1.1	1.2	1.2	1.3	1.5	1.5	2.1	2.1
62	1.2	1.2	1.3	1.4	1.8	1.8	2.9	2.9

COMPASS ERROR BY AMPLITUDE	
The true amplitudes given in the main table are calculated for the instant when the true altitude of the body is precisely 0° 00'. In the case of the sun (owing to the effects of dip, refraction and parallax) the lower limb at this instant will appear to be approximately half a diameter above the visible horizon. If the compass bearing is taken at that moment there will be no need to apply any correction.	
However, should the bearing be observed when the sun's centre appears to be in the visible horizon, the correction obtained from the subsidiary table should be applied by being added to the observed azimuth reckoned from the elevated pole as shown in the example below. (Lat. 62° N., decl. 20° S.).	
Obs'd. Azi.	S. 41° 5 E.
From elev. pole	N. 138° 5 E.
Corr'n.	+ 1° 8
Sum	N. 140° 3 E.
Corr'd. obs'd. Amp.	E. 50° 3 S.
T. Amp. from table	E. 46° 8 S.
Comp. Error	3° 5 W.
Observations of rising or setting stars and planets are seldom practicable but, if obtained, should be treated in the same way as those of the sun's centre.	
In the case of the moon that body will be approximately one-third of a degree below the horizon at the moment when its true altitude is 0° 00'. If observed when its centre appears in the visible horizon, two-thirds of the correction from the subsidiary table should be subtracted from the observed azimuth reckoned from the elevated pole.	

TABLE A HOUR ANGLE

Lat °	0°			1°		2°		3°		4°		5°		Lat °
	15'	30'	45'	00'	15'	30'	45'	00'	15'	30'	45'	00'	15'	
0	359° 45'	359° 30'	359° 15'	359° 00'	358° 45'	358° 30'	358° 15'	358° 00'	357° 45'	357° 30'	357° 15'	357° 00'	356° 45'	0
1	4-00	2-00	1-33	1-00	0-80	0-67	0-57	0-50	0-44	0-40	0-36	0-33	0-31	1
2	8-00	4-00	2-67	2-00	1-60	1-33	1-14	1-00	0-89	0-80	0-73	0-67	0-61	2
3	12-0	6-01	4-00	3-00	2-40	2-00	1-72	1-50	1-33	1-20	1-09	1-00	0-92	3
4	16-0	8-01	5-34	4-01	3-21	2-67	2-29	2-00	1-78	1-60	1-46	1-33	1-23	4
5	20-1	10-0	6-68	5-01	4-01	3-34	2-86	2-51	2-23	2-00	1-82	1-67	1-54	5
6	24-1	12-0	8-03	6-02	4-82	4-01	3-44	3-01	2-68	2-41	2-19	2-01	1-85	6
7	28-1	14-1	9-38	7-03	5-63	4-69	4-02	3-52	3-13	2-81	2-56	2-34	2-16	7
8	32-2	16-1	10-7	8-05	6-44	5-37	4-60	4-02	3-58	3-22	2-93	2-68	2-48	8
9	36-3	18-1	12-1	9-07	7-26	6-05	5-18	4-54	4-03	3-63	3-30	3-02	2-79	9
10	40-4	20-2	13-5	10-1	8-08	6-73	5-77	5-05	4-49	4-04	3-67	3-36	3-10	10
11	44-5	22-3	14-9	11-1	8-91	7-42	6-36	5-57	4-95	4-45	4-05	3-71	3-42	11
12	48-7	24-4	16-2	12-2	9-74	8-12	6-96	6-09	5-41	4-87	4-43	4-06	3-74	12
13	52-9	26-5	17-6	13-2	10-6	8-82	7-56	6-61	5-88	5-29	4-81	4-41	4-07	13
14	57-1	28-6	19-1	14-3	11-4	9-52	8-16	7-14	6-35	5-71	5-19	4-76	4-39	14
15	61-4	30-7	20-5	15-4	12-3	10-2	8-77	7-67	6-82	6-14	5-58	5-11	4-72	15
16	65-7	32-9	21-9	16-4	13-1	11-0	9-39	8-21	7-30	6-57	5-97	5-47	5-05	16
17	70-1	35-0	23-4	17-5	14-0	11-7	10-0	8-75	7-78	7-00	6-36	5-83	5-38	17
18	74-5	37-2	24-8	18-6	14-9	12-4	10-6	9-30	8-27	7-44	6-76	6-20	5-72	18
19	78-9	39-5	26-3	19-7	15-8	13-1	11-3	9-86	8-76	7-89	7-17	6-57	6-06	19
20	83-4	41-7	27-8	20-9	16-7	13-9	11-9	10-4	9-26	8-34	7-58	6-94	6-41	20
21	88-0	44-0	29-3	22-0	17-6	14-7	12-6	11-0	9-77	8-79	7-99	7-32	6-76	21
22	92-6	46-3	30-9	23-1	18-5	15-4	13-2	11-6	10-3	9-25	8-41	7-71	7-12	22
23	97-3	48-6	32-4	24-3	19-5	16-2	13-9	12-2	10-8	9-72	8-84	8-10	7-48	23
24	102	51-0	34-0	25-5	20-4	17-0	14-6	12-7	11-3	10-2	9-27	8-50	7-84	24
25	107	53-4	35-6	26-7	21-4	17-8	15-3	13-4	11-9	10-7	9-71	8-90	8-21	25
26	112	55-9	37-3	27-9	22-4	18-6	16-0	14-0	12-4	11-2	10-2	9-31	8-59	26
27	117	58-4	38-9	29-2	23-4	19-5	16-7	14-6	13-0	11-7	10-6	9-72	8-97	27
28	122	60-9	40-6	30-5	24-4	20-3	17-4	15-2	13-5	12-2	11-1	10-1	9-36	28
29	127	63-5	42-3	31-8	25-4	21-2	18-1	15-9	14-1	12-7	11-5	10-6	9-76	29
30	132	66-2	44-1	33-1	26-5	22-0	18-9	16-5	14-7	13-2	12-0	11-0	10-2	30
31	138	68-9	45-9	34-4	27-5	22-9	19-7	17-2	15-3	13-8	12-5	11-5	10-6	31
32	143	71-6	47-7	35-8	28-6	23-9	20-5	17-9	15-9	14-3	13-0	11-9	11-0	32
33	149	74-4	49-6	37-2	29-8	24-8	21-3	18-6	16-5	14-9	13-5	12-4	11-4	33
34	155	77-3	51-5	38-6	30-9	25-8	22-1	19-3	17-2	15-4	14-0	12-9	11-9	34
35	160	80-2	53-5	40-1	32-1	26-7	22-9	20-1	17-8	16-0	14-6	13-4	12-3	35
36	167	83-3	55-5	41-6	33-3	27-7	23-8	20-8	18-5	16-6	15-1	13-9	12-8	36
37	173	86-3	57-6	43-2	34-5	28-8	24-7	21-6	19-2	17-3	15-7	14-4	13-3	37
38	179	89-5	59-7	44-8	35-8	29-8	25-6	22-4	19-9	17-9	16-3	14-9	13-8	38
39	186	92-8	61-9	46-4	37-1	30-9	26-5	23-2	20-6	18-6	16-9	15-5	14-3	39
40	192	96-2	64-1	48-1	38-5	32-0	27-5	24-0	21-4	19-2	17-5	16-0	14-8	40
41	199	99-6	66-4	49-8	39-8	33-2	28-5	24-9	22-1	19-9	18-1	16-6	15-3	41
42	206	103	68-8	51-6	41-3	34-4	29-5	25-8	22-9	20-6	18-8	17-2	15-9	42
43	214	107	71-2	53-4	42-7	35-6	30-5	26-7	23-7	21-4	19-4	17-8	16-4	43
44	221	111	73-8	55-3	44-3	36-9	31-6	27-7	24-6	22-1	20-1	18-4	17-0	44
45	229	115	76-4	57-3	45-8	38-2	32-7	28-6	25-5	22-9	20-8	19-1	17-6	45
46	237	119	79-1	59-3	47-5	39-6	33-9	29-7	26-4	23-7	21-6	19-8	18-2	46
47	246	123	81-9	61-4	49-2	41-0	35-1	30-7	27-3	24-6	22-3	20-5	18-9	47
48	255	127	84-8	63-6	50-9	42-4	36-4	31-8	28-3	25-4	23-1	21-2	19-6	48
49	264	132	87-9	65-9	52-7	43-9	37-7	32-9	29-3	26-4	24-0	22-0	20-3	49
50	273	137	91-0	68-3	54-6	45-5	39-0	34-1	30-3	27-3	24-8	22-7	21-0	50
51	283	142	94-3	70-8	56-6	47-2	40-4	35-4	31-4	28-3	25-7	23-6	21-8	51
52	293	147	97-8	73-3	58-7	48-9	41-9	36-7	32-6	29-3	26-7	24-4	22-5	52
53	304	152	101	76-0	60-8	50-7	43-4	38-0	33-8	30-4	27-6	25-3	23-4	53
54	315	158	105	78-9	63-1	52-6	45-1	39-4	35-0	31-5	28-7	26-3	24-2	54
55	327	164	109	81-8	65-5	54-5	46-7	40-9	36-4	32-7	29-7	27-3	25-2	55
56	340	170	113	84-9	67-9	56-6	48-5	42-5	37-7	34-0	30-9	28-3	26-1	56
57	353	176	118	88-2	70-6	58-8	50-4	44-1	39-2	35-3	32-1	29-4	27-1	57
58	367	183	122	91-7	73-3	61-1	52-4	45-8	40-7	36-7	33-3	30-5	28-2	58
59	381	191	127	95-4	76-3	63-6	54-5	47-7	42-4	38-1	34-7	31-8	29-3	59
60	397	198	132	99-2	79-4	66-1	56-7	49-6	44-1	39-7	36-1	33-0	30-5	60
Lat	179° 45'	179° 30'	179° 15'	179° 00'	178° 45'	178° 30'	178° 15'	178° 00'	177° 45'	177° 30'	177° 15'	177° 00'	176° 45'	Lat
	180° 15'	180° 30'	180° 45'	181° 00'	181° 15'	181° 30'	181° 45'	182° 00'	182° 15'	182° 30'	182° 45'	183° 00'	183° 15'	

A - Named opposite to Latitude, except when Hour Angle is between 90° and 270°.

A - Named opposite to Latitude, except when Hour Angle is between 90° and 270°.

HOUR ANGLE

A

TABLE B HOUR ANGLE

Dec °	0°			1°			2°			3°			Dec °
	15'	30'	45'	00'	15'	30'	00'	15'	30'	00'	15'	30'	
0	359° 45'	359° 30'	359° 15'	359° 00'	358° 45'	358° 30'	358° 00'	357° 45'	357° 30'	357° 00'	356° 45'	356° 30'	0
1	4-00	2-00	1-33	1-00	0-67	0-50	0-45	0-40	0-36	0-33	0-31	0-29	1
2	8-00	4-00	2-67	2-00	1-33	1-17	1-00	0-89	0-80	0-73	0-67	0-62	2
3	12-0	6-01	4-00	3-00	2-40	2-00	1-72	1-50	1-34	1-20	1-09	1-00	3
4	16-0	8-01	5-34	4-01	3-21	2-67	2-29	2-00	1-78	1-60	1-46	1-34	4
5	20-1	10-0	6-68	5-01	4-01	3-34	2-87	2-51	2-23	2-01	1-82	1-67	5
6	24-1	12-0	8-03	6-02	4-82	4-02	3-44	3-01	2-68	2-41	2-19	2-01	6
7	28-1	14-1	9-38	7-04	5-63	4-69	4-02	3-52	3-13	2-81	2-56	2-35	7
8	32-2	16-1	10-7	8-05	6-44	5-37	4-60	4-03	3-58	3-22	2-93	2-69	8
9	36-3	18-1	12-1	9-08	7-26	6-05	5-19	4-54	4-03	3-63	3-30	3-03	9
10	40-4	20-2	13-5	10-1	8-08	6-74	5-77	5-05	4-49	4-04	3-68	3-37	10
11	44-5	22-3	14-9	11-1	8-91	7-43	6-37	5-57	4-95	4-46	4-05	3-71	11
12	48-7	24-4	16-2	12-2	9-74	8-12	6-96	6-09	5-41	4-87	4-43	4-06	12
13	52-9	26-5	17-6	13-2	10-6	8-82	7-56	6-62	5-88	5-29	4-81	4-41	13
14	57-1	28-6	19-1	14-3	11-4	9-53	8-16	7-14	6-35	5-72	5-20	4-76	14
15	61-4	30-7	20-5	15-4	12-3	10-2	8-77	7-68	6-83	6-14	5-58	5-12	15
16	65-7	32-9	21-9	16-4	13-1	11-0	9-39	8-22	7-30	6-57	5-98	5-48	16
17	70-1	35-0	23-4	17-5	14-0	11-7	10-0	8-76	7-79	7-01	6-37	5-84	17
18	74-5	37-2	24-8	18-6	14-9	12-4	10-6	9-31	8-28	7-45	6-77	6-21	18
19	78-9	39-5	26-3	19-7	15-8	13-2	11-3	9-87	8-77	7-89	7-18	6-58	19
20	83-4	41-7	27-8	20-9	16-7	13-9	11-9	10-4	9-27	8-34	7-59	6-95	20
21	88-0	44-0	29-3	22-0	17-6	14-7	12-6	11-0	9-78	8-80	8-00	7-33	21
22	92-6	46-3	30-9	23-2	18-5	15-4	13-2	11-6	10-3	9-26	8-42	7-72	22
23	97-3	48-6	32-4	24-3	19-5	16-2	13-9	12-2	10-8	9-73	8-85	8-11	23
24	102	51-0	34-0	25-5	20-4	17-0	14-6	12-8	11-3	10-2	9-28	8-51	24
25	107	53-4	35-6	26-7	21-4	17-8	15-3	13-4	11-9	10-7	9-72	8-91	25
26	112	55-9	37-3	27-9	22-4	18-6	16-0	14-0	12-4	11-2	10-2	9-32	26
27	117	58-4	38-9	29-2	23-4	19-5	16-7	14-6	13-0	11-7	10-6	9-74	27
28	122	60-9	40-6	30-5	24-4	20-3	17-4	15-2	13-5	12-2	11-1	10-2	28
29	127	63-5	42-4	31-8	25-4	21-2	18-2	15-9	14-1	12-7	11-6	10-6	29
30	132	66-2	44-1	33-1	26-5	22-1	18-9	16-5	14-7	13-2	12-0	11-0	30
31	138	68-9	45-9	34-4	27-5	23-0	19-7	17-2	15-3	13-8	12-5	11-5	31
32	143	71-6	47-7	35-8	28-6	23-9	20-5	17-9	15-9	14-3	13-0	11-9	32
33	149	74-4	49-6	37-2	29-8	24-8	21-3	18-6	16-5	14-9	13-5	12-4	33
34	155	77-3	51-5	38-6	30-9	25-8	22-1	19-3	17-2	15-5	14-1	12-9	34
35	160	80-2	53-5	40-1	32-1	26-7	22-9	20-1	17-8	16-1	14-6	13-4	35
36	167	83-3	55-5	41-6	33-3	27-8	23-8	20-8	18-5	16-7	15-1	13-9	36
37	173	86-4	57-6	43-2	34-5	28-8	24-7	21-6	19-2	17-3	15-7	14-4	37
38	179	89-5	59-7	44-8	35-8	29-8	25-6	22-4	19-9	17-9	16-3	14-9	38
39	186	92-8	61-9	46-4	37-1	30-9	26-5	23-2	20-6	18-6	16-9	15-5	39
40	192	96-2	64-1	48-1	38-5	32-1	27-5	24-0	21-4	19-2	17-5	16-0	40
41	199	99-6	66-4	49-8	39-9	33-2	28-5	24-9	22-1	19-9	18-1	16-6	41
42	206	103	68-8	51-6	41-3	34-4	29-5	25-8	22-9	20-6	18-8	17-2	42
43	214	107	71-2	53-4	42-8	35-6	30-5	26-7	23-8	21-4	19-4	17-8	43
44	221	111	73-8	55-3	44-3	36-9	31-6	27-7	24-6	22-1	20-1	18-5	44
45	229	115	76-4	57-3	45-8	38-2	32-8	28-7	25-5	22-9	20-8	19-1	45
46	237	119	79-1	59-3	47-5	39-6	33-9	29-7	26-4	23-7	21-6	19-8	46
47	246	123	81-9	61-4	49-2	41-0	35-1	30-7	27-3	24-6	22-4	20-5	47
48	255	127	84-9	63-6	50-9	42-4	36-4	31-8	28-3	25-5	23-2	21-2	48
49	264	132	87-9	65-9	52-7	43-9	37-7	33-0	29-3	26-4	24-0	22-0	49
50	273	137	91-1	68-3	54-6	45-5	39-0	34-1	30-4	27-3	24-8	22-8	50
51	283	142	94-3	70-8	56-6	47-2	40-4	35-4	31-5	28-3	25-7	23-6	51
52	293	147	97-8	73-3	58-7	48-9	41-9	36-7	32-6	29-3	26-7	24-5	52
53	304	152	101	76-0	60-8	50-7	43-5	38-0	33-8	30-4	27-7	25-4	53
54	315	158	105	78-9	63-1	52-6	45-1	39-4	35-1	31-6	28-7	26-3	54
55	327	164	109	81-8	65-5	54-6	46-8	40-9	36-4	32-7	29-8	27-3	55
56	340	170	113	84-9	68-0	56-6	48-6	42-5	37-8	34-0	30-9	28-3	56
57	353	176	118	88-2	70-6	58-8	50-4	44-1	39-2	35-3	32-1	29-4	57
58	367	183	122	91-7	73-4	61-1	52-4	45-9	40-8	36-7	33-4	30-6	58
59	381	191	127	95-4	76-3	63-6	54-5	47-7	42-4	38-2	34-7	31-8	59
60	397	198	132	99-2	79-4	66-2	56-7	49-6	44-1	39-7	36-1	33-1	60
Dec	179° 45'	179° 30'	179° 15'	179° 00'	178° 45'	178° 30'	178° 15'	178° 00'	177° 45'	177° 30'	177° 15'	177° 00'	Dec
	180° 15'	180° 30'	180° 45'	181° 00'	181° 15'	181° 30'	181° 45'	182° 00'	182° 15'	182° 30'	182° 45'	183° 00'	

B - Always named the same as Declination

B - Always named the same as Declination

B

TABLE A HOUR ANGLE

Lat. °	3° 45'	4° 00'	4° 15'	4° 30'	4° 45'	5° 00'	5° 15'	5° 30'	5° 45'	6° 00'	6° 15'	6° 30'	6° 45'	7° 00'	7° 15'	7° 30'	Lat. °
	356° 15'	356° 00'	355° 45'	355° 30'	355° 15'	355° 00'	354° 45'	354° 30'	354° 15'	354° 00'	353° 45'	353° 30'	353° 15'	353° 00'	352° 45'	352° 30'	
0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	0
1	27	25	23	22	21	20	19	18	17	17	16	15	15	14	14	13	1
2	53	50	47	44	42	40	38	36	35	33	32	31	30	28	27	27	2
3	80	75	71	67	63	60	57	54	52	50	48	46	44	43	41	40	3
4	1 07	1 00	94	89	84	80	76	73	69	67	64	61	59	57	55	53	4
5	1 33	1 25	1 18	1 11	1 05	1 00	95	91	87	83	80	77	74	71	69	66	5
6	1 60	1 50	1 41	1 34	1 26	1 20	1 14	1 09	1 04	1 00	96	92	89	86	83	80	6
7	1 87	1 76	1 65	1 56	1 48	1 40	1 34	1 28	1 22	1 17	1 12	1 08	1 04	1 00	97	93	7
8	2 14	2 01	1 89	1 79	1 69	1 61	1 53	1 46	1 40	1 34	1 28	1 23	1 19	1 14	1 10	1 07	8
9	2 42	2 27	2 13	2 01	1 91	1 81	1 72	1 65	1 57	1 51	1 45	1 39	1 34	1 29	1 25	1 20	9
10	2 69	2 52	2 37	2 24	2 12	2 02	1 92	1 83	1 75	1 68	1 61	1 55	1 49	1 44	1 39	1 34	10
11	2 97	2 78	2 62	2 47	2 34	2 22	2 12	2 02	1 93	1 85	1 77	1 71	1 64	1 58	1 53	1 48	11
12	3 24	3 04	2 86	2 70	2 56	2 43	2 31	2 21	2 11	2 02	1 94	1 87	1 80	1 73	1 67	1 61	12
13	3 52	3 30	3 11	2 93	2 78	2 64	2 51	2 40	2 29	2 20	2 11	2 03	1 95	1 88	1 81	1 75	13
14	3 80	3 57	3 35	3 17	3 00	2 85	2 71	2 59	2 48	2 37	2 28	2 19	2 11	2 03	1 96	1 89	14
15	4 09	3 83	3 61	3 40	3 22	3 06	2 92	2 78	2 66	2 55	2 45	2 35	2 26	2 18	2 11	2 04	15
16	4 37	4 10	3 86	3 64	3 45	3 28	3 12	2 98	2 85	2 73	2 62	2 52	2 42	2 34	2 25	2 18	16
17	4 66	4 37	4 11	3 88	3 68	3 49	3 33	3 18	3 04	2 91	2 79	2 68	2 58	2 49	2 40	2 32	17
18	4 96	4 65	4 37	4 13	3 91	3 71	3 54	3 38	3 23	3 09	2 97	2 85	2 75	2 65	2 55	2 47	18
19	5 25	4 92	4 63	4 38	4 14	3 94	3 75	3 58	3 42	3 28	3 14	3 02	2 91	2 80	2 71	2 62	19
20	5 55	5 21	4 90	4 62	4 38	4 16	3 96	3 78	3 61	3 46	3 32	3 19	3 08	2 96	2 86	2 76	20
21	5 86	5 49	5 17	4 88	4 62	4 39	4 18	3 99	3 81	3 65	3 51	3 37	3 24	3 13	3 02	2 92	21
22	6 16	5 78	5 44	5 13	4 86	4 62	4 40	4 20	4 01	3 84	3 69	3 55	3 41	3 29	3 18	3 07	22
23	6 48	6 07	5 71	5 39	5 11	4 85	4 62	4 41	4 22	4 04	3 88	3 73	3 59	3 46	3 34	3 22	23
24	6 79	6 37	5 99	5 66	5 36	5 09	4 85	4 62	4 42	4 24	4 07	3 91	3 76	3 63	3 50	3 38	24
25	7 11	6 67	6 27	5 92	5 61	5 33	5 08	4 84	4 63	4 44	4 26	4 09	3 94	3 80	3 67	3 54	25
26	7 44	6 98	6 56	6 20	5 87	5 57	5 31	5 07	4 84	4 64	4 45	4 28	4 12	3 97	3 83	3 70	26
27	7 77	7 29	6 86	6 47	6 13	5 82	5 55	5 29	5 06	4 85	4 65	4 47	4 30	4 15	4 01	3 87	27
28	8 11	7 60	7 15	6 76	6 40	6 08	5 79	5 52	5 28	5 06	4 85	4 67	4 49	4 33	4 18	4 04	28
29	8 46	7 93	7 46	7 04	6 67	6 34	6 03	5 76	5 50	5 27	5 06	4 87	4 68	4 52	4 36	4 21	29
30	8 81	8 26	7 77	7 34	6 95	6 60	6 28	6 00	5 73	5 49	5 27	5 07	4 88	4 70	4 54	4 39	30
31	9 17	8 59	8 09	7 63	7 23	6 87	6 54	6 24	5 97	5 72	5 49	5 27	5 08	4 89	4 72	4 56	31
32	9 53	8 94	8 41	7 94	7 52	7 14	6 80	6 49	6 21	5 95	5 71	5 48	5 28	5 09	4 91	4 75	32
33	9 91	9 29	8 74	8 25	7 82	7 42	7 07	6 74	6 45	6 18	5 93	5 70	5 49	5 29	5 10	4 93	33
34	10 3	9 65	9 08	8 57	8 12	7 71	7 34	7 01	6 70	6 42	6 16	5 92	5 70	5 49	5 30	5 12	34
35	10 7	10 0	9 42	8 90	8 43	8 00	7 62	7 27	6 95	6 66	6 39	6 15	5 92	5 70	5 50	5 32	35
36	11 1	10 4	9 78	9 23	8 74	8 30	7 91	7 55	7 22	6 91	6 63	6 38	6 14	5 92	5 71	5 52	36
37	11 5	10 8	10 1	9 57	9 07	8 61	8 20	7 83	7 48	7 17	6 88	6 61	6 37	6 14	5 92	5 72	37
38	11 9	11 2	10 5	9 93	9 40	8 93	8 50	8 11	7 76	7 43	7 13	6 86	6 60	6 36	6 14	5 93	38
39	12 4	11 6	10 9	10 3	9 75	9 26	8 81	8 41	8 04	7 70	7 39	7 11	6 84	6 60	6 37	6 15	39
40	12 8	12 0	11 3	10 7	10 1	9 59	9 13	8 71	8 33	7 98	7 66	7 36	7 09	6 83	6 60	6 37	40
41	13 3	12 4	11 7	11 0	10 5	9 94	9 46	9 03	8 63	8 27	7 94	7 63	7 34	7 08	6 83	6 60	41
42	13 7	12 9	12 1	11 4	10 8	10 3	9 80	9 35	8 94	8 57	8 22	7 90	7 61	7 33	7 08	6 84	42
43	14 2	13 3	12 5	11 8	11 2	10 7	10 1	9 68	9 26	8 87	8 51	8 18	7 88	7 59	7 33	7 08	43
44	14 7	13 8	13 0	12 3	11 6	11 0	10 5	10 0	9 59	9 19	8 82	8 48	8 16	7 86	7 59	7 34	44
45	15 3	14 3	13 5	12 7	12 0	11 4	10 9	10 4	9 93	9 51	9 13	8 78	8 45	8 14	7 86	7 60	45
46	15 8	14 8	13 9	13 2	12 5	11 8	11 3	10 8	10 3	9 85	9 46	9 09	8 75	8 43	8 14	7 87	46
47	16 4	15 3	14 4	13 6	12 9	12 3	11 7	11 1	10 6	10 2	9 79	9 41	9 06	8 73	8 43	8 15	47
48	16 9	15 9	14 9	14 1	13 4	12 7	12 1	11 5	11 0	10 6	10 1	9 75	9 38	9 05	8 73	8 44	48
49	17 6	16 5	15 5	14 6	13 8	13 1	12 5	11 9	11 4	10 9	10 5	10 1	9 72	9 37	9 04	8 74	49
50	18 2	17 0	16 0	15 1	14 3	13 6	13 0	12 4	11 8	11 3	10 9	10 5	10 1	9 71	9 37	9 05	50
51	18 8	17 7	16 6	15 7	14 9	14 1	13 4	12 8	12 3	11 7	11 3	10 8	10 4	10 1	9 71	9 38	51
52	19 5	18 3	17 2	16 3	15 4	14 6	13 9	13 3	12 7	12 2	11 7	11 2	10 8	10 4	10 1	9 72	52
53	20 2	19 0	17 9	16 9	16 0	15 2	14 4	13 8	13 2	12 6	12 1	11 6	11 2	10 8	10 4	10 1	53
54	21 0	19 7	18 5	17 5	16 6	15 7	15 0	14 3	13 7	13 1	12 6	12 1	11 6	11 2	10 8	10 5	54
55	21 8	20 4	19 2	18 1	17 2	16 3	15 5	14 8	14 2	13 6	13 0	12 5	12 1	11 6	11 2	10 8	55
56	22 6	21 2	20 0	18 8	17 8	16 9	16 1	15 4	14 7	14 1	13 5	13 0	12 5	12 1	11 7	11 3	56
57	23 5	22 0	20 7	19 6	18 5	17 6	16 8	16 0	15 3	14 7	14 1	13 5	13 0	12 5	12 1	11 7	57
58	24 4	22 9	21 5	20 3	19 3	18 3	17 4	16 6	15 9	15 2	14 6	14 0	13 5	13 0	12 6	12 2	58
59	25 4	23 8	22 4	21 1	20 0	19 0	18 1	17 3	16 5	15 8	15 2	14 6	14 1	13 6	13 1	12 6	59
60	26 4	24 8	23 3	22 0	20 8	19 8	18 8	18 0	17 2	16 5	15 8	15 2	14 6	14 1	13 6	13 2	60
Lat. °	176° 15'	176° 00'	175° 45'	175° 30'	175° 15'	175° 00'	174° 45'	174° 30'	174° 15'	174° 00'	173° 45'	173° 30'	173° 15'	173° 00'	172° 45'	172° 30'	Lat. °
	183° 45'	184° 00'	184° 15'	184° 30'	184° 45'	185° 00'	185° 15'	185° 30'	185° 45'	186° 00'	186° 15'	186° 30'	186° 45'	187° 00'	187° 15'	187° 30'	

A - Named opposite to Latitude, except when Hour Angle is between 90° and 270°.

A - Named opposite to Latitude, except when Hour Angle is between 90° and 270°.

HOUR ANGLE

TABLE B HOUR ANGLE

Dec. °	3° 45'	4° 00'	4° 15'	4° 30'	4° 45'	5° 00'	5° 15'	5° 30'	5° 45'	6° 00'	6° 15'	6° 30'	6° 45'	7° 00'	7° 15'	7° 30'	Dec. °
0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	0
1	27	25	24	22	21	20	19	18	17	17	16	15	15	14	14	13	1
2	53	50	47	45	42	40	38	36	35	33	32	31	30	29	28	27	2
3	80	75	71	67	63	60	57	55	52	50	48	46	45	43	42	40	3
4	107	100	94	89	84	80	76	73	70	67	64	62	60	57	55	54	4
5	134	125	118	112	106	100	96	91	87	84	80	77	74	72	69	67	5
6	161	151	142	134	127	121	115	110	105	101	97	93	89	86	83	81	6
7	188	176	166	156	148	141	134	128	123	117	113	108	104	101	97	94	7
8	215	201	190	179	170	161	154	147	140	134	129	124	120	115	111	108	8
9	242	227	214	202	191	182	173	165	158	152	145	140	135	130	126	121	9
10	270	253	238	225	213	202	193	184	176	169	162	156	150	145	140	135	10
11	297	279	262	248	235	223	212	203	194	186	179	172	165	159	154	149	11
12	325	305	287	271	257	244	232	222	212	203	195	188	181	174	168	163	12
13	353	331	312	294	279	265	252	241	230	221	212	204	196	189	183	177	13
14	381	357	336	318	301	286	272	260	249	239	229	220	212	205	198	191	14
15	410	384	362	341	324	307	293	280	267	256	246	237	228	220	212	205	15
16	438	411	387	365	346	329	313	299	286	274	263	253	244	235	227	220	16
17	467	438	413	390	369	351	334	319	305	292	281	270	260	251	242	234	17
18	497	466	438	414	392	373	355	339	324	311	298	287	276	267	257	249	18
19	526	494	465	439	416	395	376	359	344	329	316	304	293	283	273	264	19
20	557	522	491	464	440	418	398	380	363	348	334	322	310	299	288	279	20
21	587	550	518	489	464	440	420	401	383	367	353	339	327	315	304	294	21
22	618	579	545	515	488	464	442	422	403	387	371	357	344	332	320	310	22
23	649	609	573	541	513	487	464	443	424	406	390	375	361	348	336	325	23
24	681	638	601	567	538	511	487	465	444	426	409	393	379	365	353	341	24
25	713	668	629	594	563	535	510	487	465	446	428	412	397	383	370	357	25
26	746	699	658	622	589	560	533	509	487	467	448	431	415	400	386	374	26
27	779	730	688	649	615	585	557	532	509	487	468	450	434	418	404	390	27
28	813	762	717	678	642	610	581	555	531	509	488	470	452	436	421	407	28
29	848	795	748	706	669	636	606	578	553	530	509	490	472	455	439	425	29
30	883	828	779	736	697	662	631	602	576	552	530	510	491	474	457	442	30
31	919	861	811	766	726	689	657	627	600	575	552	531	511	493	476	460	31
32	955	896	843	796	755	717	683	652	624	598	574	552	532	513	495	479	32
33	993	931	876	828	784	745	710	678	648	621	597	574	553	533	515	498	33
34	103	967	910	860	815	774	737	704	673	645	620	596	574	554	534	517	34
35	107	100	945	892	846	803	765	731	699	670	643	619	596	575	555	536	35
36	111	104	980	926	877	834	794	758	725	695	667	642	618	596	576	557	36
37	115	108	102	960	910	865	824	786	752	721	692	666	641	618	597	577	37
38	119	112	105	996	943	896	854	815	780	747	718	690	665	641	619	599	38
39	124	116	109	1033	978	929	885	845	808	775	744	715	689	665	642	620	39
40	128	120	113	107	101	963	917	875	838	803	771	741	714	689	665	643	40
41	133	125	117	111	105	997	950	907	868	832	793	768	740	713	689	666	41
42	138	129	121	115	109	103	984	939	899	861	827	795	766	739	713	690	42
43	143	134	126	119	113	107	102	973	931	892	857	824	793	765	739	714	43
44	148	138	130	123	117	111	106	101	964	924	887	853	822	792	765	740	44
45	153	143	135	127	121	115	109	104	998	957	919	883	851	821	792	766	45
46	158	148	140	132	125	119	113	108	103	991	951	915	881	850	821	793	46
47	164	154	145	137	130	123	117	112	107	103	985	947	912	880	850	822	47
48	170	159	150	142	134	127	121	116	111	106	102	981	945	911	880	851	48
49	176	165	155	147	139	132	126	120	115	110	106	102	979	944	912	881	49
50	182	171	161	152	144	137	130	124	119	114	109	105	101	978	944	913	50
51	189	177	167	157	149	142	135	129	123	118	113	109	105	101	979	946	51
52	196	183	173	163	155	147	140	134	128	122	118	113	109	105	101	981	52
53	203	190	179	169	160	152	145	138	132	127	122	117	113	109	105	102	53
54	210	197	186	175	166	158	150	144	137	132	126	122	117	113	109	105	54
55	218	205	193	182	172	164	156	149	143	137	131	126	122	117	113	109	55
56	227	213	200	189	179	170	162	155	148	142	136	131	126	122	117	114	56
57	235	221	208	196	186	177	168	161	154	147	141	136	131	126	122	118	57
58	245	229	216	204	193	184	175	167	160	153	147	141	136	131	127	123	58
59	254	239	225	212	201	191	182	174	166	159	153	147	142	137	132	128	59
60	265	248	234	221	209	199	189	181	173	166	159	153	147	142	137	133	60
Dec. °	176° 15'	176° 00'	175° 45'	175° 30'	175° 15'	175° 00'	174° 45'	174° 30'	174° 15'	174° 00'	173° 45'	173° 30'	173° 15'	173° 00'	172° 45'	172° 30'	Dec. °
	183° 45'	184° 00'	184° 15'	184° 30'	184° 45'	185° 00'	185° 15'	185° 30'	185° 45'	186° 00'	186° 15'	186° 30'	186° 45'	187° 00'	187° 15'	187° 30'	

B - Always named the same as Declination

B - Always named the same as Declination

B HOUR ANGLE

B

TABLE A HOUR ANGLE

Lat. °	7° 30'	7° 45'	8° 00'	8° 15'	8° 30'	8° 45'	9° 00'	9° 15'	9° 30'	9° 45'	10° 00'	10° 15'	10° 30'	10° 45'	11° 00'	11° 15'	Lat. °
	352° 30'	352° 15'	352° 00'	351° 45'	351° 30'	351° 15'	351° 00'	350° 45'	350° 30'	350° 15'	350° 00'	349° 45'	349° 30'	349° 15'	349° 00'	348° 45'	
0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	0
1	.13	.13	.12	.12	.12	.11	.11	.11	.10	.10	.10	.09	.09	.09	.09	.09	1
2	.27	.26	.25	.24	.23	.23	.22	.21	.21	.20	.20	.19	.18	.18	.18	.18	2
3	.40	.39	.37	.36	.35	.34	.33	.32	.31	.30	.30	.29	.28	.28	.27	.26	3
4	.53	.51	.50	.48	.47	.45	.44	.43	.42	.41	.40	.39	.38	.37	.36	.35	4
5	.66	.64	.62	.60	.59	.57	.55	.54	.52	.51	.50	.48	.47	.46	.45	.44	5
6	.80	.77	.75	.72	.70	.68	.66	.65	.63	.61	.60	.58	.57	.55	.54	.53	6
7	.93	.90	.87	.85	.82	.80	.78	.75	.73	.72	.70	.68	.66	.65	.63	.62	7
8	1.07	1.03	1.00	.97	.94	.91	.89	.86	.84	.82	.80	.78	.76	.74	.72	.71	8
9	1.20	1.16	1.13	1.09	1.06	1.03	1.00	.97	.95	.92	.90	.88	.85	.83	.81	.80	9
10	1.34	1.30	1.25	1.22	1.18	1.15	1.11	1.08	1.05	1.03	1.00	.98	.95	.93	.91	.89	10
11	1.48	1.43	1.38	1.34	1.30	1.26	1.23	1.19	1.16	1.13	1.10	1.07	1.05	1.02	1.00	.98	11
12	1.61	1.56	1.51	1.47	1.42	1.38	1.34	1.31	1.27	1.24	1.21	1.18	1.15	1.12	1.09	1.07	12
13	1.75	1.70	1.64	1.59	1.54	1.50	1.46	1.42	1.38	1.34	1.31	1.28	1.25	1.22	1.19	1.16	13
14	1.89	1.83	1.77	1.72	1.67	1.62	1.57	1.53	1.49	1.45	1.41	1.38	1.35	1.31	1.28	1.25	14
15	2.04	1.97	1.91	1.85	1.79	1.74	1.69	1.64	1.60	1.56	1.52	1.48	1.45	1.41	1.38	1.35	15
16	2.18	2.11	2.04	1.98	1.92	1.86	1.81	1.76	1.71	1.67	1.63	1.59	1.55	1.51	1.48	1.44	16
17	2.32	2.25	2.18	2.11	2.05	1.99	1.93	1.88	1.83	1.78	1.73	1.69	1.65	1.61	1.57	1.54	17
18	2.47	2.39	2.31	2.24	2.17	2.11	2.05	2.00	1.94	1.89	1.84	1.80	1.75	1.71	1.67	1.63	18
19	2.62	2.53	2.45	2.37	2.30	2.24	2.17	2.11	2.06	2.00	1.95	1.90	1.86	1.81	1.77	1.73	19
20	2.76	2.67	2.59	2.51	2.44	2.36	2.30	2.23	2.18	2.12	2.06	2.01	1.96	1.92	1.87	1.83	20
21	2.92	2.82	2.73	2.65	2.57	2.49	2.42	2.36	2.29	2.23	2.18	2.12	2.07	2.02	1.97	1.93	21
22	3.07	2.97	2.87	2.79	2.70	2.63	2.55	2.48	2.41	2.35	2.29	2.23	2.18	2.13	2.08	2.03	22
23	3.22	3.12	3.02	2.93	2.84	2.76	2.68	2.61	2.54	2.47	2.41	2.35	2.29	2.24	2.18	2.13	23
24	3.38	3.27	3.17	3.07	2.98	2.89	2.81	2.73	2.66	2.59	2.53	2.46	2.40	2.35	2.29	2.24	24
25	3.54	3.43	3.32	3.22	3.12	3.03	2.94	2.86	2.79	2.71	2.64	2.58	2.52	2.46	2.40	2.34	25
26	3.70	3.58	3.47	3.36	3.26	3.17	3.08	2.99	2.91	2.84	2.77	2.70	2.63	2.57	2.51	2.45	26
27	3.87	3.74	3.63	3.51	3.41	3.31	3.22	3.13	3.04	2.97	2.89	2.82	2.75	2.68	2.62	2.56	27
28	4.04	3.91	3.78	3.67	3.56	3.45	3.36	3.26	3.18	3.09	3.02	2.94	2.87	2.80	2.74	2.67	28
29	4.21	4.07	3.94	3.82	3.71	3.60	3.50	3.40	3.31	3.23	3.14	3.07	2.99	2.92	2.85	2.79	29
30	4.39	4.24	4.11	3.98	3.86	3.75	3.65	3.55	3.45	3.36	3.27	3.19	3.12	3.04	2.97	2.90	30
31	4.56	4.42	4.28	4.14	4.02	3.90	3.79	3.69	3.59	3.50	3.41	3.32	3.24	3.16	3.09	3.02	31
32	4.75	4.59	4.45	4.31	4.18	4.06	3.95	3.84	3.73	3.64	3.54	3.46	3.37	3.29	3.21	3.14	32
33	4.93	4.77	4.62	4.48	4.35	4.22	4.10	3.99	3.88	3.78	3.68	3.59	3.50	3.42	3.34	3.26	33
34	5.12	4.96	4.80	4.65	4.51	4.38	4.26	4.14	4.03	3.93	3.83	3.73	3.64	3.55	3.47	3.39	34
35	5.32	5.15	4.98	4.83	4.69	4.55	4.42	4.30	4.18	4.08	3.97	3.87	3.78	3.69	3.60	3.52	35
36	5.52	5.34	5.17	5.01	4.86	4.72	4.59	4.46	4.34	4.23	4.12	4.02	3.92	3.83	3.74	3.65	36
37	5.72	5.54	5.36	5.20	5.04	4.90	4.76	4.63	4.50	4.39	4.27	4.17	4.07	3.97	3.88	3.79	37
38	5.93	5.74	5.56	5.39	5.23	5.08	4.93	4.80	4.67	4.55	4.43	4.32	4.22	4.12	4.02	3.93	38
39	6.15	5.95	5.76	5.58	5.42	5.26	5.11	4.97	4.84	4.71	4.59	4.48	4.37	4.27	4.17	4.07	39
40	6.37	6.17	5.97	5.79	5.61	5.45	5.30	5.15	5.01	4.88	4.76	4.64	4.53	4.42	4.32	4.22	40
41	6.60	6.39	6.19	6.00	5.82	5.65	5.49	5.34	5.19	5.06	4.93	4.81	4.69	4.58	4.47	4.37	41
42	6.84	6.62	6.41	6.21	6.02	5.85	5.69	5.53	5.38	5.24	5.11	4.98	4.86	4.74	4.63	4.53	42
43	7.08	6.85	6.64	6.43	6.24	6.06	5.89	5.73	5.57	5.43	5.29	5.16	5.03	4.91	4.80	4.69	43
44	7.34	7.10	6.87	6.66	6.46	6.27	6.10	5.93	5.77	5.62	5.48	5.34	5.21	5.09	4.97	4.85	44
45	7.60	7.35	7.12	6.90	6.69	6.50	6.31	6.14	5.98	5.82	5.67	5.53	5.40	5.27	5.15	5.03	45
46	7.87	7.61	7.37	7.14	6.93	6.73	6.54	6.36	6.19	6.03	5.87	5.73	5.59	5.46	5.33	5.21	46
47	8.15	7.88	7.63	7.40	7.18	6.97	6.77	6.59	6.41	6.24	6.08	5.93	5.79	5.65	5.52	5.39	47
48	8.44	8.16	7.90	7.66	7.43	7.22	7.01	6.82	6.64	6.46	6.30	6.14	5.99	5.85	5.71	5.58	48
49	8.74	8.45	8.19	7.93	7.70	7.47	7.26	7.06	6.87	6.69	6.52	6.36	6.21	6.06	5.92	5.78	49
50	9.05	8.76	8.48	8.22	7.97	7.74	7.52	7.32	7.12	6.94	6.76	6.59	6.43	6.28	6.13	5.99	50
51	9.38	9.07	8.79	8.52	8.26	8.02	7.80	7.58	7.38	7.19	7.00	6.83	6.66	6.50	6.35	6.21	51
52	9.72	9.40	9.11	8.83	8.56	8.32	8.08	7.86	7.65	7.45	7.26	7.08	6.91	6.74	6.58	6.43	52
53	10.1	9.75	9.44	9.15	8.88	8.62	8.38	8.15	7.93	7.72	7.53	7.34	7.16	6.99	6.83	6.67	53
54	10.5	10.1	9.79	9.49	9.21	8.94	8.69	8.45	8.23	8.01	7.81	7.61	7.43	7.25	7.08	6.92	54
55	10.8	10.5	10.2	9.85	9.56	9.28	9.02	8.77	8.53	8.31	8.10	7.90	7.71	7.52	7.35	7.18	55
56	11.3	10.9	10.5	10.2	9.92	9.63	9.36	9.10	8.86	8.63	8.41	8.20	8.00	7.81	7.63	7.45	56
57	11.7	11.3	11.0	10.6	10.3	10.0	9.72	9.46	9.20	8.96	8.73	8.52	8.31	8.11	7.92	7.74	57
58	12.2	11.8	11.4	11.0	10.7	10.4	10.1	9.83	9.56	9.31	9.08	8.85	8.64	8.43	8.23	8.05	58
59	12.6	12.2	11.8	11.5	11.1	10.8	10.5	10.2	9.95	9.69	9.44	9.20	8.98	8.77	8.56	8.37	59
60	13.2	12.7	12.3	11.9	11.6	11.3	10.9	10.6	10.4	10.1	9.82	9.58	9.35	9.12	8.91	8.71	60
Lat. °	172° 30'	172° 15'	172° 00'	171° 45'	171° 30'	171° 15'	171° 00'	170° 45'	170° 30'	170° 15'	170° 00'	169° 45'	169° 30'	169° 15'	169° 00'	168° 45'	Lat. °
	187° 30'	187° 15'	188° 00'	188° 15'	188° 30'	188° 45'	189° 00'	189° 15'	189° 30'	189° 45'	190° 00'	190° 15'	190° 30'	190° 45'	191° 00'	191° 15'	

A Named opposite to Latitude, except when Hour Angle is between 90° and 270°

A Named opposite to Latitude, except when Hour Angle is between 90° and 270°

TABLE B HOUR ANGLE

Dec °	7° 30'	7° 45'	8° 00'	8° 15'	8° 30'	8° 45'	9° 00'	9° 15'	9° 30'	9° 45'	10° 00'	10° 15'	10° 30'	10° 45'	11° 00'	11° 15'	Dec °
0	352° 30'	352° 15'	352° 00'	351° 45'	351° 30'	351° 15'	351° 00'	350° 45'	350° 30'	350° 15'	350° 00'	349° 45'	349° 30'	349° 15'	349° 00'	348° 45'	0
1	13	13	13	12	12	12	11	11	11	10	10	10	10	09	09	09	1
2	27	26	25	24	24	23	22	22	21	21	20	20	19	19	18	18	2
3	40	39	38	37	36	35	34	33	32	31	30	30	29	28	27	27	3
4	54	52	50	49	47	46	45	44	42	41	40	39	38	38	37	36	4
5	67	65	63	61	59	58	56	54	53	52	50	49	48	47	46	45	5
6	81	78	76	73	71	69	67	65	64	62	61	59	58	56	55	54	6
7	94	91	88	86	83	81	79	76	74	73	71	69	67	66	64	63	7
8	1 08	1 04	1 01	98	95	92	90	87	85	83	81	79	77	75	74	72	8
9	1 21	1 17	1 14	1 10	1 07	1 04	1 01	99	96	94	91	89	87	85	83	81	9
10	1 35	1 31	1 27	1 23	1 19	1 16	1 13	1 10	1 07	1 04	1 02	99	97	95	92	90	10
11	1 49	1 44	1 40	1 35	1 32	1 28	1 24	1 21	1 18	1 15	1 12	1 09	1 07	1 04	1 02	1 00	11
12	1 63	1 58	1 53	1 48	1 44	1 40	1 36	1 32	1 29	1 26	1 22	1 19	1 17	1 14	1 11	1 09	12
13	1 77	1 71	1 66	1 61	1 56	1 52	1 48	1 44	1 40	1 36	1 33	1 30	1 27	1 24	1 21	1 18	13
14	1 91	1 85	1 79	1 74	1 69	1 64	1 59	1 55	1 51	1 47	1 44	1 40	1 37	1 34	1 31	1 28	14
15	2 05	1 99	1 93	1 87	1 81	1 76	1 71	1 67	1 62	1 58	1 54	1 51	1 47	1 44	1 40	1 37	15
16	2 20	2 13	2 06	2 00	1 94	1 88	1 83	1 78	1 74	1 69	1 65	1 61	1 57	1 54	1 50	1 47	16
17	2 34	2 27	2 20	2 13	2 07	2 01	1 95	1 90	1 85	1 80	1 76	1 72	1 68	1 64	1 60	1 57	17
18	2 49	2 41	2 33	2 26	2 20	2 14	2 08	2 02	1 97	1 92	1 87	1 83	1 78	1 74	1 70	1 67	18
19	2 64	2 55	2 47	2 40	2 33	2 26	2 20	2 14	2 09	2 03	1 98	1 94	1 89	1 85	1 80	1 76	19
20	2 79	2 70	2 62	2 54	2 46	2 39	2 33	2 26	2 21	2 15	2 10	2 05	2 00	1 95	1 91	1 87	20
21	2 94	2 85	2 76	2 68	2 60	2 52	2 45	2 39	2 33	2 27	2 21	2 16	2 11	2 06	2 01	1 97	21
22	3 10	3 00	2 90	2 82	2 73	2 66	2 58	2 51	2 45	2 39	2 33	2 27	2 22	2 17	2 12	2 07	22
23	3 25	3 15	3 05	2 96	2 87	2 79	2 71	2 64	2 57	2 51	2 44	2 39	2 33	2 28	2 22	2 18	23
24	3 41	3 30	3 20	3 10	3 01	2 93	2 85	2 77	2 70	2 63	2 56	2 50	2 44	2 39	2 33	2 28	24
25	3 57	3 46	3 35	3 25	3 15	3 07	2 98	2 90	2 83	2 75	2 69	2 62	2 56	2 50	2 44	2 39	25
26	3 74	3 62	3 50	3 40	3 30	3 21	3 12	3 03	2 96	2 88	2 81	2 74	2 68	2 61	2 56	2 50	26
27	3 90	3 78	3 66	3 55	3 45	3 35	3 26	3 17	3 09	3 01	2 93	2 86	2 80	2 73	2 67	2 61	27
28	4 07	3 94	3 82	3 71	3 60	3 50	3 40	3 31	3 22	3 14	3 06	2 99	2 92	2 85	2 79	2 73	28
29	4 25	4 11	3 98	3 86	3 75	3 64	3 54	3 45	3 36	3 27	3 19	3 12	3 04	2 97	2 91	2 84	29
30	4 42	4 28	4 15	4 02	3 91	3 80	3 69	3 59	3 50	3 41	3 32	3 24	3 17	3 10	3 03	2 96	30
31	4 60	4 46	4 32	4 19	4 07	3 95	3 84	3 74	3 64	3 55	3 46	3 38	3 30	3 22	3 15	3 08	31
32	4 79	4 63	4 49	4 35	4 23	4 11	3 99	3 89	3 79	3 69	3 60	3 51	3 43	3 35	3 27	3 20	32
33	4 98	4 82	4 67	4 53	4 39	4 27	4 15	4 04	3 93	3 83	3 74	3 65	3 56	3 48	3 40	3 33	33
34	5 17	5 00	4 85	4 70	4 56	4 43	4 31	4 20	4 09	3 98	3 88	3 79	3 70	3 62	3 53	3 46	34
35	5 36	5 19	5 03	4 88	4 74	4 60	4 48	4 36	4 24	4 13	4 03	3 93	3 84	3 75	3 67	3 59	35
36	5 57	5 39	5 22	5 06	4 92	4 78	4 64	4 52	4 40	4 29	4 18	4 08	3 99	3 90	3 81	3 72	36
37	5 77	5 59	5 41	5 25	5 10	4 95	4 82	4 69	4 57	4 45	4 34	4 23	4 14	4 04	3 95	3 86	37
38	5 99	5 79	5 61	5 44	5 29	5 14	5 00	4 86	4 73	4 61	4 50	4 39	4 29	4 19	4 09	4 00	38
39	6 20	6 01	5 82	5 64	5 48	5 32	5 18	5 04	4 91	4 78	4 66	4 55	4 44	4 34	4 24	4 15	39
40	6 43	6 22	6 03	5 85	5 68	5 52	5 36	5 22	5 08	4 95	4 83	4 72	4 60	4 50	4 40	4 30	40
41	6 66	6 45	6 25	6 06	5 88	5 71	5 56	5 41	5 27	5 13	5 01	4 89	4 77	4 66	4 56	4 46	41
42	6 90	6 68	6 47	6 27	6 09	5 92	5 76	5 60	5 46	5 32	5 19	5 06	4 94	4 83	4 72	4 62	42
43	7 14	6 92	6 70	6 50	6 31	6 13	5 96	5 80	5 65	5 51	5 37	5 24	5 12	5 00	4 89	4 78	43
44	7 40	7 16	6 94	6 73	6 53	6 35	6 17	6 01	5 85	5 70	5 56	5 43	5 30	5 18	5 06	4 95	44
45	7 66	7 42	7 19	6 97	6 77	6 57	6 39	6 22	6 06	5 90	5 76	5 62	5 49	5 36	5 24	5 13	45
46	7 93	7 68	7 44	7 22	7 01	6 81	6 62	6 44	6 27	6 11	5 96	5 82	5 68	5 55	5 43	5 31	46
47	8 22	7 95	7 71	7 47	7 26	7 05	6 86	6 67	6 50	6 33	6 18	6 03	5 88	5 75	5 62	5 50	47
48	8 51	8 24	7 98	7 74	7 51	7 30	7 10	6 91	6 73	6 56	6 40	6 24	6 09	5 95	5 82	5 69	48
49	8 81	8 53	8 27	8 02	7 78	7 56	7 35	7 16	6 97	6 79	6 62	6 46	6 31	6 17	6 03	5 90	49
50	9 13	8 84	8 56	8 31	8 06	7 83	7 62	7 41	7 22	7 04	6 86	6 70	6 54	6 39	6 25	6 11	50
51	9 46	9 16	8 87	8 61	8 35	8 12	7 89	7 68	7 48	7 29	7 11	6 94	6 78	6 62	6 47	6 33	51
52	9 81	9 49	9 20	8 92	8 66	8 41	8 18	7 96	7 75	7 56	7 37	7 19	7 02	6 86	6 71	6 56	52
53	10 2	9 84	9 54	9 25	8 98	8 72	8 48	8 26	8 04	7 84	7 64	7 46	7 28	7 11	6 95	6 80	53
54	10 5	10 2	9 89	9 59	9 31	9 05	8 80	8 56	8 34	8 13	7 93	7 73	7 55	7 38	7 21	7 06	54
55	10 9	10 6	10 3	9 95	9 66	9 39	9 13	8 88	8 65	8 43	8 22	8 03	7 84	7 66	7 48	7 32	55
56	11 4	11 0	10 7	10 3	10 0	9 75	9 48	9 22	8 98	8 75	8 54	8 33	8 14	7 95	7 77	7 60	56
57	11 8	11 4	11 1	10 7	10 4	10 1	9 84	9 58	9 33	9 09	8 87	8 65	8 45	8 26	8 07	7 89	57
58	12 3	11 9	11 5	11 2	10 8	10 5	10 2	9 96	9 70	9 45	9 22	8 99	8 78	8 58	8 39	8 20	58
59	12 8	12 3	12 0	11 6	11 3	10 9	10 6	10 4	10 1	9 83	9 58	9 35	9 13	8 92	8 72	8 53	59
60	13 3	12 8	12 4	12 1	11 7	11 4	11 1	10 8	10 5	10 2	9 97	9 73	9 50	9 29	9 08	8 88	60
Dec °	172° 30'	172° 15'	172° 00'	171° 45'	171° 30'	171° 15'	171° 00'	170° 45'	170° 30'	170° 15'	170° 00'	169° 45'	169° 30'	169° 15'	169° 00'	168° 45'	Dec °
172° 30'	187° 30'	187° 45'	188° 00'	188° 15'	188° 30'	188° 45'	189° 00'	189° 15'	189° 30'	189° 45'	190° 00'	190° 15'	190° 30'	190° 45'	191° 00'	191° 15'	

HOUR ANGLE

B

B - Always named the same as Declination

B - Always named the same as Declination

TABLE A HOUR ANGLE

A - Named opposite to Latitude, except when Hour Angle is between 90° and 270°.

Lat. °	11° 15'	11° 30'	11° 45'	12° 00'	12° 15'	12° 30'	12° 45'	13° 00'	13° 15'	13° 30'	13° 45'	14° 00'	14° 15'	14° 30'	14° 45'	15° 00'	Lat. °
	348° 45'	348° 30'	348° 15'	348° 00'	347° 45'	347° 30'	347° 15'	347° 00'	346° 45'	346° 30'	346° 15'	346° 00'	345° 45'	345° 30'	345° 15'	345° 00'	
	45'	30'	15'	00'	45'	30'	15'	00'	45'	30'	15'	00'	45'	30'	15'	00'	
0	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	0
1	·09	·09	·08	·08	·08	·08	·08	·08	·07	·07	·07	·07	·07	·07	·07	·07	1
2	·18	·17	·17	·16	·16	·16	·15	·15	·15	·15	·14	·14	·14	·14	·13	·13	2
3	·26	·26	·25	·25	·24	·24	·23	·23	·22	·22	·21	·21	·21	·20	·20	·20	3
4	·35	·34	·34	·33	·32	·32	·31	·30	·30	·29	·29	·28	·28	·27	·27	·26	4
5	·44	·43	·42	·41	·40	·39	·39	·38	·37	·36	·36	·35	·34	·34	·33	·33	5
6	·53	·52	·51	·49	·48	·47	·46	·46	·45	·44	·43	·42	·41	·41	·40	·39	6
7	·62	·60	·59	·58	·57	·55	·54	·53	·52	·51	·50	·49	·48	·47	·47	·46	7
8	·71	·69	·68	·66	·65	·63	·62	·61	·60	·59	·57	·56	·55	·54	·53	·52	8
9	·80	·78	·76	·75	·73	·71	·70	·69	·67	·66	·65	·64	·62	·61	·60	·59	9
10	·89	·87	·85	·83	·81	·80	·78	·76	·75	·73	·72	·71	·69	·68	·67	·66	10
11	·98	·96	·94	·91	·90	·88	·86	·84	·83	·81	·79	·78	·77	·75	·74	·73	11
12	1·07	1·04	1·02	1·00	·98	·96	·94	·92	·90	·89	·87	·85	·84	·82	·81	·79	12
13	1·16	1·13	1·11	1·09	1·06	1·04	1·02	1·00	·98	·96	·94	·93	·91	·89	·88	·86	13
14	1·25	1·23	1·20	1·17	1·15	1·12	1·10	1·08	1·06	1·04	1·02	1·00	·98	·96	·95	·93	14
15	1·35	1·32	1·29	1·26	1·23	1·21	1·18	1·16	1·14	1·12	1·10	1·07	1·06	1·04	1·02	1·00	15
16	1·44	1·41	1·38	1·35	1·32	1·29	1·27	1·24	1·22	1·19	1·17	1·15	1·13	1·11	1·09	1·07	16
17	1·54	1·50	1·47	1·44	1·41	1·38	1·35	1·32	1·30	1·27	1·25	1·23	1·20	1·18	1·16	1·14	17
18	1·63	1·60	1·56	1·53	1·50	1·47	1·44	1·41	1·38	1·35	1·33	1·30	1·28	1·26	1·23	1·21	18
19	1·73	1·69	1·66	1·62	1·59	1·55	1·52	1·49	1·46	1·43	1·41	1·38	1·36	1·33	1·31	1·29	19
20	1·83	1·79	1·75	1·71	1·68	1·64	1·61	1·58	1·55	1·52	1·49	1·46	1·43	1·41	1·38	1·36	20
21	1·93	1·89	1·85	1·81	1·77	1·73	1·70	1·66	1·63	1·60	1·57	1·54	1·51	1·48	1·46	1·43	21
22	2·03	1·99	1·94	1·90	1·86	1·82	1·79	1·75	1·72	1·68	1·65	1·62	1·59	1·56	1·53	1·51	22
23	2·13	2·09	2·04	2·00	1·96	1·91	1·88	1·84	1·80	1·77	1·73	1·70	1·67	1·64	1·61	1·58	23
24	2·24	2·19	2·14	2·09	2·05	2·01	1·97	1·93	1·89	1·85	1·82	1·79	1·75	1·72	1·69	1·66	24
25	2·34	2·29	2·24	2·19	2·15	2·10	2·06	2·02	1·98	1·94	1·91	1·87	1·84	1·80	1·77	1·74	25
26	2·45	2·40	2·34	2·29	2·25	2·20	2·16	2·11	2·07	2·03	1·99	1·96	1·92	1·89	1·85	1·82	26
27	2·56	2·50	2·45	2·40	2·35	2·30	2·25	2·21	2·16	2·12	2·08	2·04	2·01	1·97	1·94	1·90	27
28	2·67	2·61	2·56	2·50	2·45	2·40	2·35	2·30	2·26	2·21	2·17	2·13	2·09	2·06	2·02	1·98	28
29	2·79	2·73	2·66	2·61	2·55	2·50	2·45	2·40	2·35	2·31	2·27	2·22	2·18	2·14	2·11	2·07	29
30	2·90	2·84	2·78	2·72	2·66	2·60	2·55	2·50	2·45	2·40	2·36	2·32	2·27	2·23	2·19	2·15	30
31	3·02	2·95	2·89	2·83	2·77	2·71	2·66	2·60	2·55	2·50	2·46	2·41	2·37	2·32	2·28	2·24	31
32	3·14	3·07	3·00	2·94	2·88	2·82	2·76	2·71	2·65	2·60	2·55	2·51	2·46	2·42	2·37	2·33	32
33	3·26	3·19	3·12	3·06	2·99	2·93	2·87	2·81	2·76	2·71	2·66	2·61	2·56	2·51	2·47	2·42	33
34	3·39	3·32	3·24	3·17	3·11	3·04	2·98	2·92	2·86	2·81	2·76	2·71	2·66	2·61	2·56	2·52	34
35	3·52	3·44	3·37	3·29	3·22	3·16	3·09	3·03	2·97	2·92	2·86	2·81	2·76	2·71	2·66	2·61	35
36	3·65	3·57	3·49	3·42	3·35	3·28	3·21	3·15	3·09	3·03	2·97	2·91	2·86	2·81	2·76	2·71	36
37	3·79	3·70	3·62	3·55	3·47	3·40	3·33	3·26	3·20	3·14	3·08	3·02	2·97	2·91	2·86	2·81	37
38	3·93	3·84	3·76	3·68	3·60	3·52	3·45	3·38	3·32	3·25	3·19	3·13	3·08	3·02	2·97	2·92	38
39	4·07	3·98	3·89	3·81	3·73	3·65	3·58	3·51	3·44	3·37	3·31	3·25	3·19	3·13	3·08	3·02	39
40	4·22	4·12	4·03	3·95	3·86	3·78	3·71	3·63	3·56	3·50	3·43	3·37	3·30	3·24	3·19	3·13	40
41	4·37	4·27	4·18	4·09	4·00	3·92	3·84	3·77	3·69	3·62	3·55	3·49	3·42	3·36	3·30	3·24	41
42	4·53	4·43	4·33	4·24	4·15	4·06	3·98	3·90	3·82	3·75	3·68	3·61	3·55	3·48	3·42	3·36	42
43	4·69	4·58	4·48	4·39	4·30	4·21	4·12	4·04	3·96	3·88	3·81	3·74	3·67	3·61	3·54	3·48	43
44	4·85	4·75	4·64	4·54	4·45	4·36	4·27	4·18	4·10	4·02	3·95	3·87	3·80	3·73	3·67	3·60	44
45	5·03	4·92	4·81	4·70	4·61	4·51	4·42	4·33	4·25	4·17	4·09	4·01	3·94	3·87	3·80	3·73	45
46	5·21	5·09	4·98	4·87	4·77	4·67	4·58	4·49	4·40	4·31	4·23	4·15	4·08	4·00	3·93	3·86	46
47	5·39	5·27	5·16	5·05	4·94	4·84	4·74	4·65	4·56	4·47	4·38	4·30	4·22	4·15	4·07	4·00	47
48	5·58	5·46	5·34	5·23	5·12	5·01	4·91	4·81	4·72	4·63	4·54	4·45	4·37	4·29	4·22	4·14	48
49	5·78	5·65	5·53	5·43	5·30	5·19	5·08	4·98	4·89	4·79	4·70	4·61	4·53	4·45	4·37	4·29	49
50	5·99	5·86	5·73	5·61	5·49	5·38	5·27	5·16	5·06	4·96	4·87	4·78	4·69	4·61	4·53	4·45	50
51	6·21	6·07	5·94	5·81	5·69	5·57	5·46	5·35	5·24	5·14	5·05	4·95	4·86	4·77	4·69	4·61	51
52	6·43	6·29	6·15	6·02	5·90	5·77	5·66	5·55	5·44	5·33	5·23	5·13	5·04	4·95	4·86	4·78	52
53	6·67	6·52	6·38	6·24	6·11	5·99	5·86	5·75	5·64	5·53	5·42	5·32	5·23	5·13	5·04	4·95	53
54	6·92	6·77	6·62	6·48	6·34	6·21	6·08	5·96	5·85	5·73	5·62	5·52	5·42	5·32	5·23	5·14	54
55	7·18	7·02	6·87	6·72	6·58	6·44	6·31	6·19	6·07	5·95	5·84	5·73	5·62	5·52	5·42	5·33	55
56	7·45	7·29	7·13	6·97	6·83	6·69	6·55	6·42	6·30	6·18	6·06	5·95	5·84	5·73	5·63	5·53	56
57	7·74	7·57	7·40	7·24	7·09	6·95	6·81	6·67	6·54	6·41	6·29	6·18	6·06	5·95	5·85	5·75	57
58	8·05	7·87	7·69	7·53	7·37	7·22	7·07	6·93	6·80	6·67	6·54	6·42	6·30	6·19	6·08	5·97	58
59	8·37	8·18	8·00	7·83	7·67	7·51	7·36	7·21	7·07	6·93	6·80	6·68	6·55	6·44	6·32	6·21	59
60	8·71	8·51	8·33	8·15	7·98	7·81	7·65	7·50	7·36	7·21	7·08	6·95	6·82	6·70	6·58	6·46	60
Lat. °	168° 45'	168° 30'	168° 15'	168° 00'	167° 45'	167° 30'	167° 15'	167° 00'	166° 45'	166° 30'	166° 15'	166° 00'	165° 45'	165° 30'	165° 15'	165° 00'	Lat. °
	191° 15'	191° 30'	191° 45'	192° 00'	192° 15'	192° 30'	192° 45'	193° 00'	193° 15'	193° 30'	193° 45'	194° 00'	194° 15'	194° 30'	194° 45'	195° 00'	
	15'	30'	45'	00'	15'	30'	45'	00'	15'	30'	45'	00'	15'	30'	45'	00'	
61	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	61
62	·09	·09	·08	·08	·08	·08	·08	·08	·07	·07	·07	·07	·07	·07	·07	·07	62
63	·18	·17	·17	·16	·16	·16	·15	·15	·15	·15	·14	·14	·14	·14	·13	·13	63
64	·26	·26	·25	·25	·24	·24	·23	·23	·22	·22	·21	·21	·21	·20	·20	·20	64
65	·35	·34	·34	·33	·32	·32	·31	·30	·30	·29	·29	·28	·28	·27	·27	·26	65
66	·44	·43	·42	·41	·40	·39	·39	·38	·37	·36	·36	·35	·34	·34	·33	·33	66
67	·53	·52	·51	·49	·48	·47	·46	·46	·45	·44	·43	·42	·41	·41	·40	·39	67
68	·62	·60	·59	·58	·57	·55	·54	·53	·52	·51	·50	·49	·48	·47	·47	·46	68
69	·71	·69	·68	·66	·65	·63	·62	·61									

TABLE B HOUR ANGLE

Dec °	11° 15' 30'	11° 30' 45'	11° 45' 00'	12° 00' 15'	12° 15' 30'	12° 30' 45'	12° 45' 00'	13° 00' 15'	13° 15' 30'	13° 30' 45'	13° 45' 00'	14° 00' 15'	14° 15' 30'	14° 30' 45'	14° 45' 00'	15° 00' 15'	Dec °
0	348° 45'	348° 30'	348° 15'	348° 00'	347° 45'	347° 30'	347° 15'	347° 00'	346° 45'	346° 30'	346° 15'	346° 00'	345° 45'	345° 30'	345° 15'	345° 00'	0
1	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	1
2	09	09	09	08	08	08	08	08	08	07	07	07	07	07	07	07	2
3	18	18	17	17	17	16	16	16	15	15	15	14	14	14	14	13	3
4	27	26	26	25	25	24	24	23	23	22	22	22	21	21	21	20	4
5	36	35	34	34	33	32	32	31	31	30	29	29	28	28	28	27	5
6	45	44	43	42	41	40	40	39	38	38	37	36	36	35	34	34	6
7	54	53	52	51	50	49	48	47	46	45	44	43	43	42	41	41	7
8	63	62	60	59	58	57	56	55	54	53	52	51	50	49	48	47	8
9	72	71	69	68	66	65	64	62	61	60	59	58	57	56	55	54	9
10	81	79	78	76	75	73	72	70	69	68	67	65	64	63	62	61	10
11	90	88	87	85	83	82	80	78	77	76	74	73	72	70	69	68	11
12	100	98	96	93	92	90	88	86	85	83	82	80	79	78	76	75	12
13	109	107	104	102	100	98	96	94	93	91	89	88	86	85	84	82	13
14	118	116	113	111	109	107	105	103	101	99	97	95	94	92	91	89	14
15	128	125	122	120	118	115	113	111	109	107	105	103	101	100	98	96	15
16	137	134	132	129	126	124	121	119	117	115	113	111	109	107	105	104	16
17	147	144	141	138	135	132	130	127	125	123	121	119	116	115	113	111	17
18	157	153	150	147	144	141	139	136	133	131	129	126	124	122	120	118	18
19	167	163	160	156	153	150	147	144	142	139	137	134	132	130	128	126	19
20	176	173	169	166	162	159	156	153	150	147	145	142	140	138	135	133	20
21	187	183	179	175	172	168	165	162	159	156	153	150	148	145	143	141	21
22	197	193	189	185	181	177	174	171	167	164	162	159	156	153	151	148	22
23	207	203	198	194	190	187	183	180	176	173	170	167	164	161	159	156	23
24	218	213	208	204	200	196	192	189	185	182	179	175	172	170	167	164	24
25	228	223	219	214	210	206	202	198	194	191	187	184	181	178	175	172	25
26	239	234	229	224	220	215	211	207	203	200	196	193	189	186	183	180	26
27	250	245	240	235	230	225	221	217	213	209	205	202	198	195	192	188	27
28	261	256	250	245	240	235	231	227	222	218	214	211	207	204	200	197	28
29	273	267	261	256	251	246	241	236	232	228	224	220	216	212	209	205	29
30	284	278	272	267	261	256	251	246	242	237	233	229	225	221	218	214	30
31	296	290	284	278	272	267	262	257	252	247	243	239	235	231	227	223	31
32	308	301	295	289	283	278	272	267	262	257	253	248	244	240	236	232	32
33	320	313	307	301	295	289	283	278	273	268	263	258	254	250	245	241	33
34	333	326	319	312	306	300	294	289	283	278	273	268	264	259	255	251	34
35	346	338	331	324	318	312	306	300	294	289	284	279	274	269	265	261	35
36	359	351	344	337	330	324	317	311	306	300	295	289	284	280	275	271	36
37	372	364	357	349	342	336	329	323	317	311	306	300	295	290	285	281	37
38	386	378	370	362	355	348	341	335	329	323	317	311	306	301	296	291	38
39	400	392	384	376	368	361	354	347	341	335	329	323	317	312	307	302	39
40	415	406	398	390	382	374	367	360	353	347	341	335	329	323	318	313	40
41	430	421	412	404	395	388	380	373	366	359	353	347	341	335	330	324	41
42	446	436	427	418	410	402	394	386	379	372	366	359	353	347	341	336	42
43	462	452	442	433	424	416	408	400	393	386	379	372	366	360	354	348	43
44	478	468	458	449	439	431	423	415	407	399	392	385	379	372	366	360	44
45	495	484	474	464	455	446	438	429	421	414	406	399	392	386	379	373	45
46	513	502	491	481	471	462	453	445	436	428	421	413	406	399	393	386	46
47	531	519	509	498	488	478	469	460	452	444	436	428	421	414	407	400	47
48	550	538	527	516	505	496	486	477	468	459	451	443	436	428	421	414	48
49	569	557	545	534	523	513	503	494	485	476	467	459	451	444	436	429	49
50	590	577	565	553	542	531	521	511	502	493	484	476	467	459	452	444	50
51	611	598	585	573	562	551	540	530	520	511	501	493	484	476	468	460	51
52	633	619	606	594	582	571	560	549	539	529	520	510	502	493	485	477	52
53	656	642	629	616	603	591	580	569	558	548	539	529	520	511	503	495	53
54	680	666	652	638	625	613	601	590	579	568	558	549	539	530	521	513	54
55	706	690	676	662	649	636	624	612	601	590	579	569	559	550	541	532	55
56	732	716	701	687	673	660	647	635	623	612	601	590	580	570	561	552	56
57	760	744	728	713	699	685	672	659	647	635	624	613	602	592	582	573	57
58	789	772	756	741	726	712	698	685	672	660	648	637	626	615	605	595	58
59	820	803	786	770	754	739	725	711	698	686	673	662	650	639	629	618	59
60	853	835	817	800	784	769	754	740	726	713	700	688	676	665	654	643	60
60	888	869	851	833	816	800	785	770	756	742	729	716	704	692	680	669	60
Dec	168° 45' 30'	168° 30' 45'	168° 15' 00'	168° 00' 15'	167° 45' 30'	167° 30' 45'	167° 15' 00'	167° 00' 15'	166° 45' 30'	166° 30' 45'	166° 15' 00'	166° 00' 15'	165° 45' 30'	165° 30' 45'	165° 15' 00'	165° 00' 15'	Dec
	191° 15'	191° 30'	191° 45'	192° 00'	192° 15'	192° 30'	192° 45'	193° 00'	193° 15'	193° 30'	193° 45'	194° 00'	194° 15'	194° 30'	194° 45'	195° 00'	

HOUR ANGLE

B - Always named the same as Declination

B

TABLE A HOUR ANGLE

A - Named opposite to Latitude, except when Hour Angle is between 90° and 270°.

TABLE A HOUR ANGLE																																	
Lat	15°		15°		16°		16°		17°		17°		18°		18°		19°		19°		20°		20°		21°		21°		22°		22°		Lat
	00'	30'	00'	30'	00'	30'	00'	30'	00'	30'	00'	30'	00'	30'	00'	30'	00'	30'	00'	30'	00'	30'	00'	30'	00'	30'	00'	30'	00'	30'	00'	30'	
	345°	344°	344°	343°	343°	342°	342°	341°	341°	340°	340°	339°	339°	338°	338°	337°	337°	336°	336°	335°	335°	334°	334°	333°	333°	332°	332°	331°	331°	330°	330°		
0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	0	
1	07	06	06	06	06	06	06	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	05	1	
2	13	13	12	12	12	11	11	11	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	2	
3	20	19	18	18	17	17	16	16	15	15	15	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	3	
4	26	25	24	24	23	22	22	21	20	20	20	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	4	
5	33	32	31	30	29	28	27	26	25	25	25	24	23	23	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	5
6	39	38	37	35	34	33	32	31	31	30	30	29	28	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	6	
7	46	44	43	41	40	39	38	37	36	35	34	33	32	31	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	7	
8	52	51	49	47	46	45	43	42	41	40	39	38	37	36	35	34	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	8	
9	59	57	55	53	52	50	49	47	46	45	44	42	41	40	39	38	37	36	35	34	33	32	31	30	30	30	30	30	30	30	30	9	
10	66	64	61	60	58	56	54	53	51	50	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	30	30	10	
11	73	70	68	66	64	62	60	58	56	55	53	52	51	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	11	
12	79	77	74	72	70	67	65	64	62	60	58	57	55	54	53	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	12	
13	86	83	81	78	76	73	71	69	67	65	63	62	60	59	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	13	
14	93	90	87	84	82	79	77	75	72	70	69	67	65	63	62	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	14	
15	100	97	93	90	88	85	82	80	78	76	74	72	70	68	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	15	
16	107	103	100	97	94	91	88	86	83	81	79	77	75	73	71	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	16	
17	114	110	107	103	100	97	94	91	89	86	84	82	80	78	76	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	17	
18	121	117	113	110	106	103	100	97	94	92	89	87	85	82	80	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	18	
19	129	124	120	116	113	109	106	103	100	97	95	92	90	87	85	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	19	
20	136	131	127	123	119	115	112	109	106	103	100	97	95	92	90	88	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	20	
21	143	138	134	130	126	122	118	115	111	108	105	103	100	97	95	93	92	91	90	89	88	87	86	85	84	83	82	81	80	79	78	21	
22	151	146	141	136	132	128	124	121	117	114	111	108	105	103	100	97	95	93	92	91	90	89	88	87	86	85	84	83	82	81	80	22	
23	158	153	148	143	139	135	131	127	123	120	117	114	111	108	105	102	100	98	96	94	92	90	88	86	84	82	80	78	76	74	72	23	
24	166	161	155	150	146	141	137	133	129	126	122	119	116	113	110	107	104	102	100	98	96	94	92	90	88	86	84	82	80	78	76	24	
25	174	168	163	157	153	148	144	139	135	132	128	125	121	118	115	113	110	107	104	102	100	98	96	94	92	90	88	86	84	82	80	25	
26	182	176	170	165	160	155	150	146	142	138	134	130	127	124	121	118	115	113	110	107	104	102	100	98	96	94	92	90	88	86	84	26	
27	190	184	178	172	167	162	157	152	148	144	140	136	133	129	126	123	120	117	114	111	108	105	103	100	97	95	93	91	89	87	85	27	
28	198	192	185	179	174	169	164	159	154	150	146	142	139	135	132	128	125	122	119	116	113	110	107	104	102	100	98	96	94	92	90	28	
29	207	200	193	187	181	176	171	166	161	157	152	148	144	141	137	134	130	127	124	121	118	115	113	110	107	104	102	100	98	96	94	29	
30	215	208	201	195	189	183	178	173	168	163	159	154	150	147	143	139	136	132	129	126	123	120	117	114	111	108	105	103	100	97	95	30	
31	224	217	210	203	197	191	185	180	175	170	165	161	157	153	149	145	142	138	135	132	128	125	122	119	116	113	110	107	104	102	100	31	
32	233	225	218	211	204	198	192	187	181	176	172	167	163	159	155	151	147	144	140	137	134	130	127	124	121	118	115	113	110	107	104	32	
33	242	234	226	219	212	206	200	194	189	183	178	174	169	165	161	157	153	149	146	142	139	135	132	128	125	122	119	116	113	110	107	33	
34	252	243	235	228	221	214	208	202	196	190	185	180	176	171	167	163	159	155	151	147	144	141	137	134	130	127	124	121	118	115	113	34	
35	261	252	244	236	229	222	216	209	203	198	192	187	182	178	173	169	165	161	157	153	149	146	142	139	135	132	128	125	122	119	116	35	
36	271	262	253	245	238	230	224	217	211	205	200	194	189	184	180	175	171	167	163	159	155	151	147	144	141	137	134	130	127	124	121	36	
37	281	272	263	254	246	239	232	225	219	213	207	202	196	191	187	182	178	174	170	166	162	158	154	150	146	143	139	135	132	128	125	37	
38	292	282	272	264	256	248	240	234	227	221	215	209	204	198	193	189	184	180	176	172	168	164	160	156	152	148	144	141	137	134	130	38	
39	302	292	282	273	265	257	249	242	235	229	223	217	211	206	200	195	190	186	182	178	174	170	166	162	158	154	150	146	143	139	135	39	
40	313	303	293	283	274	266	258	251	244	237	231	225	219	213	208	203	198	193	189	185	181	177	173	169	165	1							

TABLE B HOUR ANGLE

Dec °	15° 00'	15° 30'	16° 00'	16° 30'	17° 00'	17° 30'	18° 00'	18° 30'	19° 00'	19° 30'	20° 00'	20° 30'	21° 00'	21° 30'	22° 00'	22° 30'	Dec °
	345° 00'	344° 30'	344° 00'	343° 30'	343° 00'	342° 30'	342° 00'	341° 30'	341° 00'	340° 30'	340° 00'	339° 30'	339° 00'	338° 30'	338° 00'	337° 30'	
0	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	0
1	·07	·07	·06	·06	·06	·06	·06	·05	·05	·05	·05	·05	·05	·05	·05	·05	1
2	·13	·13	·13	·12	·12	·12	·11	·11	·11	·10	·10	·10	·10	·10	·09	·09	2
3	·20	·20	·19	·19	·18	·17	·17	·17	·16	·16	·15	·15	·15	·14	·14	·14	3
4	·27	·26	·25	·25	·24	·23	·23	·22	·21	·21	·20	·20	·20	·19	·19	·18	4
5	·34	·33	·32	·31	·30	·29	·28	·28	·27	·26	·26	·25	·24	·24	·23	·23	5
6	·41	·39	·38	·37	·36	·35	·34	·33	·32	·31	·31	·30	·29	·29	·28	·27	6
7	·47	·46	·45	·43	·42	·41	·40	·39	·38	·37	·36	·35	·34	·34	·33	·32	7
8	·54	·53	·51	·49	·48	·47	·45	·44	·43	·42	·41	·40	·39	·38	·38	·37	8
9	·61	·59	·57	·56	·54	·53	·51	·50	·49	·47	·46	·45	·44	·43	·42	·41	9
10	·68	·66	·64	·62	·60	·59	·57	·56	·54	·53	·52	·50	·49	·48	·47	·46	10
11	·75	·73	·71	·68	·66	·65	·63	·61	·60	·58	·57	·55	·54	·53	·52	·51	11
12	·82	·80	·77	·75	·73	·71	·69	·67	·65	·64	·62	·61	·59	·58	·57	·56	12
13	·89	·86	·84	·81	·79	·77	·75	·73	·71	·69	·68	·66	·64	·63	·62	·60	13
14	·96	·93	·90	·88	·85	·83	·81	·79	·77	·75	·73	·71	·70	·68	·67	·65	14
15	1·04	1·00	·97	·94	·92	·89	·87	·84	·82	·80	·78	·77	·75	·73	·72	·70	15
16	1·11	1·07	1·04	1·01	·98	·95	·93	·90	·88	·86	·84	·82	·80	·78	·77	·75	16
17	1·18	1·14	1·11	1·08	1·05	1·02	·99	·96	·94	·92	·89	·87	·85	·83	·82	·80	17
18	1·26	1·22	1·18	1·14	1·11	1·08	1·05	1·02	1·00	·97	·95	·93	·91	·89	·87	·85	18
19	1·33	1·29	1·25	1·21	1·18	1·15	1·11	1·09	1·06	1·03	1·01	·98	·96	·94	·92	·90	19
20	1·41	1·36	1·32	1·28	1·24	1·21	1·18	1·15	1·12	1·09	1·06	1·04	1·02	·99	·97	·95	20
21	1·48	1·44	1·39	1·35	1·31	1·28	1·24	1·21	1·18	1·15	1·12	1·10	1·07	1·05	1·02	1·00	21
22	1·56	1·51	1·47	1·42	1·38	1·34	1·31	1·27	1·24	1·21	1·18	1·15	1·13	1·10	1·08	1·06	22
23	1·64	1·59	1·54	1·49	1·45	1·41	1·37	1·34	1·30	1·27	1·24	1·21	1·18	1·16	1·13	1·11	23
24	1·72	1·67	1·62	1·57	1·52	1·48	1·44	1·40	1·37	1·33	1·30	1·27	1·24	1·21	1·19	1·16	24
25	1·80	1·74	1·69	1·64	1·59	1·55	1·51	1·47	1·43	1·40	1·36	1·33	1·30	1·27	1·24	1·22	25
26	1·88	1·83	1·77	1·72	1·67	1·62	1·58	1·54	1·50	1·46	1·43	1·39	1·36	1·33	1·30	1·27	26
27	1·97	1·91	1·85	1·79	1·74	1·69	1·65	1·61	1·57	1·53	1·49	1·45	1·42	1·39	1·36	1·33	27
28	2·05	1·99	1·93	1·87	1·82	1·77	1·72	1·68	1·63	1·59	1·55	1·52	1·48	1·45	1·42	1·39	28
29	2·14	2·07	2·01	1·95	1·90	1·84	1·79	1·75	1·70	1·66	1·62	1·58	1·55	1·51	1·48	1·45	29
30	2·23	2·16	2·09	2·03	1·97	1·92	1·87	1·82	1·77	1·73	1·69	1·65	1·61	1·58	1·54	1·51	30
31	2·32	2·25	2·18	2·12	2·06	2·00	1·94	1·89	1·85	1·80	1·76	1·72	1·68	1·64	1·60	1·57	31
32	2·41	2·34	2·27	2·20	2·14	2·08	2·02	1·97	1·92	1·87	1·83	1·78	1·74	1·70	1·67	1·63	32
33	2·51	2·43	2·36	2·29	2·22	2·16	2·10	2·05	1·99	1·95	1·90	1·85	1·81	1·77	1·73	1·70	33
34	2·61	2·52	2·45	2·37	2·31	2·24	2·18	2·13	2·07	2·02	1·97	1·93	1·88	1·84	1·80	1·76	34
35	2·71	2·62	2·54	2·46	2·39	2·33	2·27	2·21	2·15	2·10	2·05	2·00	1·95	1·91	1·87	1·83	35
36	2·81	2·72	2·64	2·56	2·48	2·42	2·35	2·29	2·23	2·18	2·12	2·07	2·03	1·98	1·94	1·90	36
37	2·91	2·82	2·73	2·65	2·58	2·51	2·44	2·37	2·31	2·26	2·20	2·15	2·10	2·06	2·01	1·97	37
38	3·02	2·92	2·83	2·75	2·67	2·60	2·53	2·46	2·40	2·34	2·28	2·23	2·18	2·13	2·09	2·04	38
39	3·13	3·03	2·94	2·85	2·77	2·69	2·62	2·55	2·49	2·43	2·37	2·31	2·26	2·21	2·16	2·12	39
40	3·24	3·14	3·04	2·95	2·87	2·79	2·72	2·64	2·58	2·51	2·45	2·40	2·34	2·29	2·24	2·19	40
41	3·36	3·25	3·15	3·06	2·97	2·89	2·81	2·74	2·67	2·60	2·54	2·48	2·43	2·37	2·32	2·27	41
42	3·48	3·37	3·27	3·17	3·08	2·99	2·91	2·84	2·77	2·70	2·63	2·57	2·51	2·46	2·40	2·35	42
43	3·60	3·49	3·38	3·28	3·19	3·10	3·02	2·94	2·86	2·79	2·73	2·66	2·60	2·54	2·49	2·44	43
44	3·73	3·61	3·50	3·40	3·30	3·21	3·13	3·04	2·97	2·89	2·82	2·76	2·69	2·63	2·58	2·52	44
45	3·86	3·74	3·63	3·52	3·42	3·33	3·24	3·15	3·07	3·00	2·92	2·86	2·79	2·73	2·67	2·61	45
46	4·00	3·87	3·76	3·65	3·54	3·44	3·35	3·26	3·18	3·10	3·03	2·96	2·89	2·83	2·76	2·71	46
47	4·14	4·01	3·89	3·78	3·67	3·57	3·47	3·38	3·29	3·21	3·14	3·06	2·99	2·93	2·86	2·80	47
48	4·29	4·16	4·03	3·91	3·80	3·69	3·59	3·50	3·41	3·33	3·25	3·17	3·10	3·03	2·96	2·90	48
49	4·44	4·30	4·17	4·05	3·93	3·83	3·72	3·63	3·53	3·45	3·36	3·28	3·21	3·14	3·07	3·01	49
50	4·60	4·46	4·32	4·20	4·08	3·96	3·86	3·76	3·66	3·57	3·48	3·40	3·33	3·25	3·18	3·11	50
51	4·77	4·62	4·48	4·35	4·22	4·11	4·00	3·89	3·79	3·70	3·61	3·53	3·45	3·37	3·30	3·23	51
52	4·95	4·79	4·64	4·51	4·38	4·26	4·14	4·03	3·93	3·83	3·74	3·65	3·57	3·49	3·42	3·35	52
53	5·13	4·97	4·81	4·67	4·54	4·42	4·29	4·18	4·08	3·98	3·88	3·79	3·70	3·62	3·54	3·47	53
54	5·32	5·15	4·99	4·85	4·71	4·58	4·45	4·34	4·23	4·12	4·02	3·93	3·84	3·76	3·67	3·60	54
55	5·52	5·34	5·18	5·03	4·88	4·75	4·62	4·50	4·39	4·28	4·18	4·08	3·99	3·90	3·81	3·73	55
56	5·73	5·55	5·38	5·22	5·07	4·93	4·80	4·67	4·55	4·44	4·34	4·23	4·14	4·05	3·96	3·87	56
57	5·95	5·76	5·59	5·42	5·27	5·12	4·98	4·85	4·73	4·61	4·50	4·40	4·30	4·20	4·11	4·02	57
58	6·18	5·99	5·81	5·63	5·47	5·32	5·18	5·04	4·92	4·79	4·68	4·57	4·47	4·37	4·27	4·18	58
59	6·43	6·23	6·04	5·86	5·69	5·54	5·39	5·25	5·11	4·99	4·87	4·75	4·64	4·54	4·44	4·35	59
60	6·69	6·48	6·28	6·10	5·92	5·76	5·61	5·46	5·32	5·19	5·06	4·95	4·83	4·73	4·62	4·53	60
Dec.	165° 00'	164° 30'	164° 00'	163° 30'	163° 00'	162° 30'	162° 00'	161° 30'	161° 00'	160° 30'	160° 00'	159° 30'	159° 00'	158° 30'	158° 00'	157° 30'	Dec
	195° 00'	195° 30'	196° 00'	196° 30'	197° 00'	197° 30'	198° 00'	198° 30'	199° 00'	199° 30'	200° 00'	200° 30'	201° 00'	201° 30'	202° 00'	202° 30'	

B Always named the same as Declination

B Always named the same as Declination

B

TABLE A HOUR ANGLE

Lat. °	22° 30'	23° 00'	23° 30'	24° 00'	24° 30'	25° 00'	25° 30'	26° 00'	26° 30'	27° 00'	27° 30'	28° 00'	28° 30'	29° 00'	29° 30'	30° 00'	Lat. °
0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	0
1	04	04	04	04	04	04	04	04	03	03	03	03	03	03	03	03	1
2	08	08	08	08	08	07	07	07	07	07	07	06	06	06	06	06	2
3	13	12	12	12	12	11	11	11	11	10	10	10	09	09	09	09	3
4	17	16	16	16	15	15	15	14	14	14	13	13	13	12	12	12	4
5	21	21	20	20	19	19	18	18	18	17	17	16	16	16	15	15	5
6	25	25	24	24	23	23	22	22	21	21	20	20	19	19	19	18	6
7	30	29	28	28	27	26	26	25	25	24	24	23	23	22	22	21	7
8	34	33	32	32	31	30	29	29	28	28	27	26	26	25	25	24	8
9	38	37	36	36	35	34	33	32	32	31	30	30	29	29	28	27	9
10	43	42	41	40	39	38	37	36	35	35	34	33	33	32	31	31	10
11	47	46	45	44	43	42	41	40	39	38	37	37	36	35	34	34	11
12	51	50	49	48	47	46	45	44	43	42	41	40	39	38	38	37	12
13	56	54	53	52	51	50	48	47	46	45	44	43	43	42	41	40	13
14	60	59	57	56	55	53	52	51	50	49	48	47	46	45	44	43	14
15	65	63	62	60	59	57	56	55	54	53	51	50	49	48	47	46	15
16	69	68	66	64	63	61	60	59	58	56	55	54	53	52	51	50	16
17	74	72	70	69	67	66	64	63	61	60	59	58	56	55	54	53	17
18	78	77	75	73	71	70	68	67	65	64	62	61	60	59	57	56	18
19	83	81	79	77	76	74	72	71	69	68	66	65	63	62	61	60	19
20	88	86	84	82	80	78	76	75	73	71	70	68	67	66	64	63	20
21	93	90	88	86	84	82	81	79	77	75	74	72	71	69	68	66	21
22	97	95	93	91	89	87	85	83	81	79	78	76	74	73	71	70	22
23	1 02	1 00	98	95	93	91	89	87	85	83	82	80	78	77	75	74	23
24	1 07	1 05	1 02	1 00	98	95	93	91	89	87	86	84	82	80	79	77	24
25	1 13	1 10	1 07	1 05	1 02	1 00	98	96	94	92	90	88	86	84	82	81	25
26	1 18	1 15	1 12	1 10	1 07	1 05	1 02	1 00	98	96	94	92	90	88	86	84	26
27	1 23	1 20	1 17	1 14	1 12	1 09	1 07	1 04	1 02	1 00	98	96	94	92	90	88	27
28	1 28	1 25	1 22	1 19	1 17	1 14	1 11	1 09	1 07	1 04	1 02	1 00	98	96	94	92	28
29	1 34	1 31	1 27	1 25	1 22	1 19	1 16	1 14	1 11	1 09	1 06	1 04	1 02	1 00	98	96	29
30	1 39	1 36	1 33	1 30	1 27	1 24	1 21	1 18	1 16	1 13	1 11	1 09	1 06	1 04	1 02	1 00	30
31	1 45	1 42	1 38	1 35	1 32	1 29	1 26	1 23	1 21	1 18	1 15	1 13	1 11	1 08	1 06	1 04	31
32	1 51	1 47	1 44	1 40	1 37	1 34	1 31	1 28	1 25	1 23	1 20	1 18	1 15	1 13	1 10	1 08	32
33	1 57	1 53	1 49	1 46	1 42	1 39	1 36	1 33	1 30	1 27	1 25	1 22	1 20	1 17	1 15	1 12	33
34	1 63	1 59	1 55	1 51	1 48	1 45	1 41	1 38	1 35	1 32	1 30	1 27	1 24	1 22	1 19	1 17	34
35	1 69	1 65	1 61	1 57	1 54	1 50	1 47	1 44	1 40	1 37	1 35	1 32	1 29	1 26	1 24	1 21	35
36	1 75	1 71	1 67	1 63	1 59	1 56	1 52	1 49	1 46	1 43	1 40	1 37	1 34	1 31	1 28	1 26	36
37	1 82	1 78	1 73	1 69	1 65	1 62	1 58	1 55	1 51	1 48	1 45	1 42	1 39	1 36	1 33	1 31	37
38	1 89	1 84	1 80	1 75	1 71	1 68	1 64	1 60	1 57	1 53	1 50	1 47	1 44	1 41	1 38	1 35	38
39	1 95	1 91	1 86	1 82	1 78	1 74	1 70	1 66	1 62	1 59	1 56	1 52	1 49	1 46	1 43	1 40	39
40	2 03	1 98	1 93	1 88	1 84	1 80	1 76	1 72	1 68	1 65	1 61	1 58	1 55	1 51	1 48	1 45	40
41	2 10	2 05	2 00	1 95	1 91	1 86	1 82	1 78	1 74	1 71	1 67	1 63	1 60	1 57	1 54	1 51	41
42	2 17	2 12	2 07	2 02	1 98	1 93	1 89	1 85	1 81	1 77	1 73	1 69	1 66	1 62	1 59	1 56	42
43	2 25	2 20	2 14	2 09	2 05	2 00	1 96	1 91	1 87	1 83	1 79	1 75	1 72	1 68	1 65	1 62	43
44	2 33	2 28	2 22	2 17	2 12	2 07	2 02	1 98	1 94	1 90	1 86	1 82	1 78	1 74	1 71	1 67	44
45	2 41	2 36	2 30	2 25	2 19	2 14	2 10	2 05	2 01	1 96	1 92	1 88	1 84	1 80	1 77	1 73	45
46	2 50	2 44	2 38	2 33	2 27	2 22	2 17	2 12	2 08	2 03	1 99	1 95	1 91	1 87	1 83	1 79	46
47	2 59	2 53	2 47	2 41	2 35	2 30	2 25	2 20	2 15	2 10	2 06	2 02	1 98	1 93	1 90	1 86	47
48	2 68	2 62	2 55	2 49	2 44	2 38	2 33	2 28	2 23	2 18	2 13	2 09	2 05	2 00	1 96	1 92	48
49	2 78	2 71	2 65	2 58	2 52	2 47	2 41	2 36	2 31	2 26	2 21	2 16	2 12	2 08	2 03	1 99	49
50	2 88	2 81	2 74	2 68	2 62	2 56	2 50	2 44	2 39	2 34	2 29	2 24	2 19	2 15	2 11	2 06	50
51	2 98	2 91	2 84	2 77	2 71	2 65	2 59	2 53	2 48	2 42	2 37	2 32	2 27	2 23	2 18	2 14	51
52	3 09	3 02	2 94	2 87	2 81	2 74	2 68	2 62	2 57	2 51	2 46	2 41	2 36	2 31	2 26	2 22	52
53	3 20	3 13	3 05	2 98	2 91	2 85	2 78	2 72	2 66	2 60	2 55	2 50	2 44	2 39	2 35	2 30	53
54	3 32	3 24	3 17	3 09	3 02	2 95	2 89	2 82	2 76	2 70	2 64	2 59	2 53	2 48	2 43	2 38	54
55	3 45	3 36	3 28	3 21	3 13	3 06	2 99	2 93	2 86	2 80	2 74	2 69	2 63	2 58	2 52	2 47	55
56	3 58	3 49	3 41	3 33	3 25	3 18	3 11	3 04	2 97	2 91	2 85	2 79	2 73	2 67	2 62	2 57	56
57	3 72	3 63	3 54	3 46	3 38	3 30	3 23	3 16	3 09	3 02	2 96	2 90	2 84	2 78	2 72	2 67	57
58	3 86	3 77	3 68	3 59	3 51	3 43	3 36	3 28	3 21	3 14	3 07	3 01	2 95	2 89	2 83	2 77	58
59	4 02	3 92	3 83	3 74	3 65	3 57	3 49	3 41	3 34	3 27	3 20	3 13	3 07	3 00	2 94	2 88	59
60	4 18	4 08	3 98	3 89	3 80	3 71	3 63	3 55	3 47	3 40	3 33	3 26	3 19	3 12	3 06	3 00	60
Lat. °	157° 30'	157° 00'	156° 30'	156° 00'	155° 30'	155° 00'	154° 30'	154° 00'	153° 30'	153° 00'	152° 30'	152° 00'	151° 30'	151° 00'	150° 30'	150° 00'	Lat. °
	202° 30'	203° 00'	203° 30'	204° 00'	204° 30'	205° 00'	205° 30'	206° 00'	206° 30'	207° 00'	207° 30'	208° 00'	208° 30'	209° 00'	209° 30'	210° 00'	

A - Named opposite to Latitude, except when Hour Angle is between 90° and 270°.

A - Named opposite to Latitude, except when Hour Angle is between 90° and 270°.

HOUR ANGLE

A

TABLE B HOUR ANGLE

Dec °	22° 30'	23° 00'	23° 30'	24° 00'	24° 30'	25° 00'	25° 30'	26° 00'	26° 30'	27° 00'	27° 30'	28° 00'	28° 30'	29° 00'	29° 30'	30° 00'	Dec °
	337° 30'	337° 00'	336° 30'	336° 00'	335° 30'	335° 00'	334° 30'	334° 00'	333° 30'	333° 00'	332° 30'	332° 00'	331° 30'	331° 00'	330° 30'	330° 00'	
0	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	0
1	-05	-04	-04	-04	-04	-04	-04	-04	-04	-04	-04	-04	-04	-04	-04	-03	1
2	-09	-09	-09	-09	-08	-08	-08	-08	-08	-08	-08	-07	-07	-07	-07	-07	2
3	-14	-13	-13	-13	-13	-12	-12	-12	-12	-11	-11	-11	-11	-11	-11	-10	3
4	-18	-18	18	-17	-17	-17	-16	-16	-16	-15	-15	-15	-15	-14	-14	-14	4
5	-23	-22	-22	-22	-21	-21	-20	-20	-20	-19	-19	-19	-18	-18	-18	-17	5
6	-27	-27	-26	-26	-25	-25	-24	-24	-24	-23	-23	-22	-22	-22	-21	-21	6
7	-32	-31	-31	-30	-30	-29	-29	-28	-28	-27	-27	-26	-26	-25	-25	-25	7
8	-37	-36	-35	-35	-34	-33	-33	-32	-31	-31	-30	-30	-29	-29	-29	-28	8
9	-41	-41	-40	-39	-38	-37	-37	-36	-35	-35	-34	-34	-33	-33	-32	-32	9
10	-46	-45	-44	-43	-43	-42	-41	-40	-40	-39	-38	-38	-37	-36	-36	-35	10
11	-51	-50	-49	-48	-47	-46	-45	-44	-44	-43	-42	-41	-41	-40	-39	-39	11
12	-56	-54	-53	-52	-51	-50	-49	-48	-48	-47	-46	-45	-45	-44	-43	-43	12
13	-60	-59	-58	-57	-56	-55	-54	-53	-52	-51	-50	-49	-48	-48	-47	-46	13
14	-65	-64	-63	-61	-60	-59	-58	-57	-56	-55	-54	-53	-52	-51	-51	-50	14
15	-70	-69	-67	-66	-65	-63	-62	-61	-60	-59	-58	-57	-56	-55	-54	-54	15
16	-75	-73	-72	-71	-69	-68	-67	-65	-64	-63	-62	-61	-60	-59	-58	-57	16
17	-80	-78	-77	-75	-74	-72	-71	-70	-69	-67	-66	-65	-64	-63	-62	-61	17
18	-85	-83	-81	-80	-78	-77	-75	-74	-73	-72	-70	-69	-68	-67	-66	-65	18
19	-90	-88	-86	-85	-83	-81	-80	-79	-77	-76	-75	-73	-72	-71	-70	-69	19
20	-95	-93	-91	-89	-88	-86	-85	-83	-82	-80	-79	-78	-76	-75	-74	-73	20
21	1 00	-98	-96	-94	-93	-91	-89	-88	-86	-85	-83	-82	-80	-79	-78	-77	21
22	1 06	1 03	1 01	-99	-97	-96	-94	-92	-91	-89	-87	-86	-85	-83	-82	-81	22
23	1 11	1 09	1 06	1 04	1 02	1 00	-99	-97	-95	-93	-92	-90	-89	-88	-86	-85	23
24	1 16	1 14	1 12	1 09	1 07	1 05	1 03	1 02	1 00	-98	-96	-95	-93	-92	-90	-89	24
25	1 22	1 19	1 17	1 15	1 12	1 10	1 08	1 06	1 05	1 03	1 01	-99	-98	-96	-95	-93	25
26	1 27	1 25	1 22	1 20	1 18	1 15	1 13	1 11	1 09	1 07	1 06	1 04	1 02	1 01	-99	-98	26
27	1 33	1 30	1 28	1 25	1 23	1 21	1 18	1 16	1 14	1 12	1 10	1 09	1 07	1 05	1 03	1 02	27
28	1 39	1 36	1 33	1 31	1 28	1 26	1 24	1 21	1 19	1 17	1 15	1 13	1 11	1 10	1 08	1 06	28
29	1 45	1 42	1 39	1 36	1 34	1 31	1 29	1 26	1 24	1 22	1 20	1 18	1 16	1 14	1 13	1 11	29
30	1 51	1 48	1 45	1 42	1 39	1 37	1 34	1 32	1 29	1 27	1 25	1 23	1 21	1 19	1 17	1 15	30
31	1 57	1 54	1 51	1 48	1 45	1 42	1 40	1 37	1 35	1 32	1 30	1 28	1 26	1 24	1 22	1 20	31
32	1 63	1 60	1 57	1 54	1 51	1 48	1 45	1 43	1 40	1 38	1 35	1 33	1 31	1 29	1 27	1 25	32
33	1 70	1 66	1 63	1 60	1 57	1 54	1 51	1 48	1 46	1 43	1 41	1 38	1 36	1 34	1 32	1 30	33
34	1 76	1 73	1 69	1 66	1 63	1 60	1 57	1 54	1 51	1 49	1 46	1 44	1 41	1 39	1 37	1 35	34
35	1 83	1 79	1 76	1 72	1 69	1 66	1 63	1 60	1 57	1 54	1 52	1 49	1 47	1 44	1 42	1 40	35
36	1 90	1 86	1 82	1 79	1 75	1 72	1 69	1 66	1 63	1 60	1 57	1 55	1 52	1 50	1 48	1 45	36
37	1 97	1 93	1 89	1 85	1 82	1 78	1 75	1 72	1 69	1 66	1 63	1 61	1 58	1 55	1 53	1 51	37
38	2 04	2 00	1 96	1 92	1 88	1 85	1 81	1 78	1 75	1 72	1 69	1 66	1 64	1 61	1 59	1 56	38
39	2 12	2 07	2 03	1 99	1 95	1 92	1 88	1 85	1 81	1 78	1 75	1 72	1 70	1 67	1 64	1 62	39
40	2 19	2 15	2 10	2 06	2 02	1 99	1 95	1 91	1 88	1 85	1 82	1 79	1 76	1 73	1 70	1 68	40
41	2 27	2 22	2 18	2 14	2 10	2 06	2 02	1 98	1 95	1 91	1 88	1 85	1 82	1 79	1 77	1 74	41
42	2 35	2 30	2 26	2 21	2 17	2 13	2 09	2 05	2 02	1 98	1 95	1 92	1 89	1 86	1 83	1 80	42
43	2 44	2 39	2 34	2 29	2 25	2 21	2 17	2 13	2 09	2 05	2 02	1 99	1 95	1 92	1 89	1 87	43
44	2 52	2 47	2 42	2 37	2 33	2 29	2 24	2 20	2 16	2 13	2 09	2 06	2 02	1 99	1 96	1 93	44
45	2 61	2 56	2 51	2 46	2 41	2 37	2 32	2 28	2 24	2 20	2 17	2 13	2 10	2 06	2 03	2 00	45
46	2 71	2 65	2 60	2 55	2 50	2 45	2 41	2 36	2 32	2 28	2 24	2 21	2 17	2 14	2 10	2 07	46
47	2 80	2 74	2 69	2 64	2 59	2 54	2 49	2 45	2 40	2 36	2 32	2 28	2 25	2 21	2 18	2 14	47
48	2 90	2 84	2 79	2 73	2 68	2 63	2 58	2 53	2 49	2 45	2 41	2 37	2 33	2 29	2 26	2 22	48
49	3 01	2 94	2 88	2 83	2 77	2 72	2 67	2 62	2 58	2 53	2 49	2 45	2 41	2 37	2 34	2 30	49
50	3 11	3 05	2 99	2 93	2 87	2 82	2 77	2 72	2 67	2 63	2 58	2 54	2 50	2 46	2 42	2 38	50
51	3 23	3 16	3 10	3 04	2 98	2 92	2 87	2 82	2 77	2 72	2 67	2 63	2 59	2 55	2 51	2 47	51
52	3 35	3 28	3 21	3 15	3 09	3 03	2 97	2 92	2 87	2 82	2 77	2 73	2 68	2 64	2 60	2 56	52
53	3 47	3 40	3 33	3 26	3 20	3 14	3 08	3 03	2 97	2 92	2 87	2 83	2 78	2 74	2 69	2 65	53
54	3 60	3 52	3 45	3 38	3 32	3 26	3 20	3 14	3 08	3 03	2 98	2 93	2 88	2 84	2 80	2 75	54
55	3 73	3 66	3 58	3 51	3 44	3 38	3 32	3 26	3 20	3 15	3 09	3 04	2 99	2 95	2 90	2 86	55
56	3 87	3 79	3 72	3 65	3 58	3 51	3 44	3 38	3 32	3 27	3 21	3 16	3 11	3 06	3 01	2 97	56
57	4 02	3 94	3 86	3 79	3 71	3 64	3 58	3 51	3 45	3 39	3 34	3 28	3 23	3 18	3 13	3 08	57
58	4 18	4 10	4 01	3 93	3 86	3 79	3 72	3 65	3 59	3 53	3 47	3 41	3 35	3 30	3 25	3 20	58
59	4 35	4 26	4 17	4 09	4 01	3 94	3 87	3 80	3 73	3 67	3 60	3 55	3 49	3 43	3 38	3 33	59
60	4 53	4 43	4 34	4 26	4 18	4 10	4 02	3 95	3 88	3 82	3 75	3 69	3 63	3 57	3 52	3 46	60
Dec.	157° 30'	157° 00'	156° 30'	156° 00'	155° 30'	155° 00'	154° 30'	154° 00'	153° 30'	153° 00'	152° 30'	152° 00'	151° 30'	151° 00'	150° 30'	150° 00'	Dec.
	202° 30'	203° 00'	203° 30'	204° 00'	204° 30'	205° 00'	205° 30'	206° 00'	206° 30'	207° 00'	207° 30'	208° 00'	208° 30'	209° 00'	209° 30'	210° 00'	

HOUR ANGLE

B

B - Always named the same as Declination

B - Always named the same as Declination

TABLE A HOUR ANGLE

A - Named opposite to Latitude, except when Hour Angle is between 90° and 270°

Lat °	30°	31°	32°	33°	34°	35°	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	Lat °
	330°	329°	328°	327°	326°	325°	324°	323°	322°	321°	320°	319°	318°	317°	316°	315°	
0	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	0
1	·03	·03	·03	·03	·03	·02	·02	·02	·02	·02	·02	·02	·02	·02	·02	·02	1
2	·06	·06	·06	·05	·05	·05	·05	·05	·04	·04	·04	·04	·04	·04	·04	·04	2
3	·09	·09	·08	·08	·08	·07	·07	·07	·07	·06	·06	·06	·06	·06	·05	·05	3
4	·12	·12	·11	·11	·10	·10	·10	·09	·09	·09	·08	·08	·08	·07	·07	·07	4
5	·15	·15	·14	·13	·13	·12	·12	·12	·11	·11	·10	·10	·10	·09	·09	·09	5
6	·18	·17	·17	·16	·16	·15	·14	·14	·13	·13	·13	·12	·12	·11	·11	·11	6
7	·21	·20	·20	·19	·18	·18	·17	·16	·16	·15	·15	·14	·14	·13	·13	·12	7
8	·24	·23	·22	·22	·21	·20	·19	·19	·18	·17	·17	·16	·16	·15	·15	·14	8
9	·27	·26	·25	·24	·23	·23	·22	·21	·20	·20	·19	·18	·18	·17	·16	·16	9
10	·31	·29	·28	·27	·26	·25	·24	·23	·23	·22	·21	·20	·20	·19	·18	·18	10
11	·34	·32	·31	·30	·29	·28	·27	·26	·25	·24	·23	·22	·22	·21	·20	·19	11
12	·37	·35	·34	·33	·32	·30	·29	·28	·27	·26	·25	·24	·24	·23	·22	·21	12
13	·40	·38	·37	·36	·34	·33	·32	·31	·30	·29	·28	·27	·26	·25	·24	·23	13
14	·43	·41	·40	·38	·37	·36	·34	·33	·32	·31	·30	·29	·27	·27	·26	·25	14
15	·46	·45	·43	·41	·40	·38	·37	·36	·34	·33	·32	·31	·30	·29	·28	·27	15
16	·50	·48	·46	·44	·43	·41	·39	·38	·37	·35	·34	·33	·32	·31	·30	·29	16
17	·53	·51	·49	·47	·45	·44	·42	·41	·39	·38	·36	·35	·34	·33	·32	·31	17
18	·56	·54	·52	·50	·48	·46	·45	·43	·42	·40	·39	·37	·36	·35	·34	·32	18
19	·60	·57	·55	·53	·51	·49	·47	·46	·44	·43	·41	·40	·38	·37	·36	·34	19
20	·63	·61	·58	·56	·54	·52	·50	·48	·47	·45	·43	·42	·40	·39	·38	·36	20
21	·66	·64	·61	·59	·57	·55	·53	·51	·49	·47	·46	·44	·43	·41	·40	·38	21
22	·70	·67	·65	·62	·60	·58	·56	·54	·52	·50	·48	·46	·45	·43	·42	·40	22
23	·74	·71	·68	·65	·63	·61	·58	·56	·54	·52	·51	·49	·47	·45	·44	·42	23
24	·77	·74	·71	·69	·66	·64	·61	·59	·57	·55	·53	·51	·49	·48	·46	·45	24
25	·81	·78	·75	·72	·69	·67	·64	·62	·60	·58	·56	·54	·52	·50	·48	·47	25
26	·84	·81	·78	·75	·72	·70	·67	·65	·62	·60	·58	·56	·54	·52	·51	·49	26
27	·88	·85	·82	·78	·76	·73	·70	·68	·65	·63	·61	·59	·57	·55	·53	·51	27
28	·92	·88	·85	·82	·79	·76	·73	·71	·68	·66	·63	·61	·59	·57	·55	·53	28
29	·96	·92	·89	·85	·82	·79	·76	·74	·71	·68	·66	·64	·62	·59	·57	·55	29
30	1·00	·96	·92	·89	·86	·82	·79	·77	·74	·71	·69	·66	·64	·62	·60	·58	30
31	1·04	1·00	·96	·93	·89	·86	·83	·80	·77	·74	·72	·69	·67	·64	·62	·60	31
32	1·08	1·04	1·00	·96	·93	·89	·86	·83	·80	·77	·74	·72	·69	·67	·65	·62	32
33	1·12	1·08	1·04	1·00	·96	·93	·89	·86	·83	·80	·77	·75	·72	·70	·67	·65	33
34	1·17	1·12	1·08	1·04	1·00	·96	·93	·90	·86	·83	·80	·78	·75	·72	·70	·67	34
35	1·21	1·17	1·12	1·08	1·04	1·00	·96	·93	·90	·86	·83	·81	·78	·75	·73	·70	35
36	1·26	1·21	1·16	1·12	1·08	1·04	1·00	·96	·93	·90	·87	·84	·81	·78	·75	·73	36
37	1·31	1·25	1·21	1·16	1·12	1·08	1·04	1·00	·96	·93	·90	·87	·84	·81	·78	·75	37
38	1·35	1·30	1·25	1·20	1·16	1·12	1·08	1·04	1·00	·96	·93	·90	·87	·84	·81	·78	38
39	1·40	1·35	1·30	1·25	1·20	1·16	1·11	1·07	1·04	1·00	·97	·93	·90	·87	·84	·81	39
40	1·45	1·40	1·34	1·29	1·24	1·20	1·15	1·11	1·07	1·04	1·00	·97	·93	·90	·87	·84	40
41	1·51	1·45	1·39	1·34	1·29	1·24	1·20	1·15	1·11	1·07	1·04	1·00	·97	·93	·90	·87	41
42	1·56	1·50	1·44	1·39	1·33	1·29	1·24	1·19	1·15	1·11	1·07	1·04	1·00	·97	·93	·90	42
43	1·62	1·55	1·49	1·44	1·38	1·33	1·28	1·24	1·19	1·15	1·11	1·07	1·04	1·00	·97	·93	43
44	1·67	1·61	1·55	1·49	1·43	1·38	1·33	1·28	1·24	1·19	1·15	1·11	1·07	1·04	1·00	·97	44
45	1·73	1·66	1·60	1·54	1·48	1·43	1·38	1·33	1·28	1·23	1·19	1·15	1·11	1·07	1·04	1·00	45
46	1·79	1·72	1·66	1·59	1·54	1·48	1·43	1·37	1·33	1·28	1·23	1·19	1·15	1·11	1·07	1·04	46
47	1·86	1·78	1·72	1·65	1·59	1·53	1·48	1·42	1·37	1·32	1·28	1·23	1·19	1·15	1·11	1·07	47
48	1·92	1·85	1·78	1·71	1·65	1·59	1·53	1·47	1·42	1·37	1·32	1·28	1·23	1·19	1·15	1·11	48
49	1·99	1·91	1·84	1·77	1·71	1·64	1·58	1·53	1·47	1·42	1·37	1·32	1·28	1·23	1·19	1·15	49
50	2·06	1·98	1·91	1·84	1·77	1·70	1·64	1·58	1·53	1·47	1·42	1·37	1·32	1·28	1·23	1·19	50
51	2·14	2·06	1·98	1·90	1·83	1·76	1·70	1·64	1·58	1·52	1·47	1·42	1·37	1·32	1·28	1·23	51
52	2·22	2·13	2·05	1·97	1·90	1·83	1·76	1·70	1·64	1·58	1·52	1·47	1·42	1·37	1·33	1·28	52
53	2·30	2·21	2·12	2·04	1·97	1·90	1·83	1·76	1·70	1·64	1·58	1·52	1·47	1·42	1·37	1·33	53
54	2·38	2·29	2·20	2·12	2·04	1·97	1·89	1·83	1·76	1·70	1·64	1·58	1·53	1·48	1·43	1·38	54
55	2·47	2·38	2·29	2·20	2·12	2·04	1·97	1·90	1·83	1·76	1·70	1·64	1·59	1·53	1·48	1·43	55
56	2·57	2·47	2·37	2·28	2·20	2·12	2·04	1·97	1·90	1·83	1·77	1·71	1·65	1·59	1·54	1·48	56
57	2·67	2·56	2·46	2·37	2·28	2·20	2·12	2·04	1·97	1·90	1·84	1·77	1·71	1·65	1·59	1·54	57
58	2·77	2·66	2·56	2·46	2·37	2·29	2·20	2·12	2·05	1·98	1·91	1·84	1·78	1·72	1·66	1·60	58
59	2·88	2·77	2·66	2·56	2·47	2·38	2·29	2·21	2·13	2·06	1·98	1·91	1·85	1·78	1·72	1·66	59
60	3·00	2·88	2·77	2·67	2·57	2·47	2·38	2·30	2·22	2·14	2·06	1·99	1·92	1·86	1·79	1·73	60
Lat	150°	149°	148°	147°	146°	145°	144°	143°	142°	141°	140°	139°	138°	137°	136°	135°	Lat
	210°	211°	212°	213°	214°	215°	216°	217°	218°	219°	220°	221°	222°	223°	224°	225°	

A - Named opposite to Latitude, except when Hour Angle is between 90° and 270°

HOUR ANGLE

TABLE B HOUR ANGLE

Dec °	30°	31°	32°	33°	34°	35°	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	Dec °
	330°	329°	328°	327°	326°	325°	324°	323°	322°	321°	320°	319°	318°	317°	316°	315°	
0	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	0
1	·03	·03	·03	·03	·03	·03	·03	·03	·03	·03	·03	·03	·03	·03	·03	·03	1
2	·07	·07	·07	·06	·06	·06	·06	·06	·06	·06	·05	·05	·05	·05	·05	·05	2
3	·10	·10	·10	·10	·09	·09	·09	·09	·09	·08	·08	·08	·08	·08	·08	·07	3
4	·14	·14	·13	·13	·13	·12	·12	·12	·11	·11	·11	·11	·10	·10	·10	·10	4
5	·17	·17	·17	·16	·16	·15	·15	·15	·14	·14	·14	·13	·13	·13	·13	·12	5
6	·21	·20	·20	·19	·19	·18	·18	·17	·17	·17	·16	·16	·16	·15	·15	·15	6
7	·25	·24	·23	·23	·22	·21	·21	·20	·20	·20	·19	·19	·18	·18	·18	·17	7
8	·28	·27	·27	·26	·25	·25	·24	·23	·22	·22	·22	·21	·21	·21	·20	·20	8
9	·32	·31	·30	·29	·28	·28	·27	·26	·25	·25	·25	·24	·24	·23	·23	·22	9
10	·35	·34	·33	·32	·32	·31	·30	·29	·28	·27	·27	·26	·26	·25	·25	·25	10
11	·39	·38	·37	·36	·35	·34	·33	·32	·32	·31	·30	·30	·29	·29	·28	·27	11
12	·43	·41	·40	·39	·38	·37	·36	·35	·35	·34	·33	·32	·32	·31	·31	·30	12
13	·46	·45	·44	·42	·41	·40	·39	·38	·37	·37	·36	·35	·35	·34	·33	·33	13
14	·50	·48	·47	·46	·45	·43	·42	·41	·40	·40	·39	·38	·37	·37	·36	·35	14
15	·54	·52	·51	·49	·48	·47	·46	·45	·44	·43	·42	·41	·40	·39	·39	·38	15
16	·57	·56	·54	·53	·51	·50	·49	·48	·47	·46	·45	·44	·43	·42	·41	·41	16
17	·61	·59	·58	·56	·55	·53	·52	·51	·50	·49	·48	·47	·46	·45	·44	·43	17
18	·65	·63	·61	·60	·58	·57	·55	·54	·53	·52	·51	·50	·49	·48	·47	·46	18
19	·69	·67	·65	·63	·62	·60	·59	·57	·56	·55	·54	·52	·51	·50	·50	·49	19
20	·73	·71	·69	·67	·65	·63	·62	·60	·59	·58	·57	·55	·54	·53	·52	·51	20
21	·77	·75	·72	·70	·69	·67	·65	·64	·62	·61	·60	·59	·57	·56	·55	·54	21
22	·81	·78	·76	·74	·72	·70	·69	·67	·66	·64	·63	·62	·60	·59	·58	·57	22
23	·85	·82	·80	·78	·76	·74	·72	·71	·69	·67	·66	·65	·63	·62	·61	·60	23
24	·89	·86	·84	·82	·80	·78	·76	·74	·72	·71	·69	·68	·67	·65	·64	·63	24
25	·93	·91	·88	·86	·83	·81	·79	·77	·76	·74	·73	·71	·70	·68	·67	·66	25
26	·98	·95	·92	·90	·87	·85	·83	·81	·79	·78	·76	·74	·73	·72	·70	·69	26
27	1·02	·99	·96	·94	·91	·89	·87	·85	·83	·81	·79	·78	·76	·75	·73	·72	27
28	1·06	1·03	1·00	·98	·95	·93	·90	·88	·86	·84	·83	·81	·79	·78	·77	·75	28
29	1·11	1·08	1·05	1·02	·99	·97	·94	·92	·90	·88	·86	·84	·83	·81	·80	·78	29
30	1·15	1·12	1·09	1·06	1·03	1·01	·98	·96	·94	·92	·90	·88	·86	·85	·83	·82	30
31	1·20	1·17	1·13	1·10	1·07	1·05	1·02	1·00	·98	·95	·93	·92	·90	·88	·87	·85	31
32	1·25	1·21	1·18	1·15	1·12	1·09	1·06	1·04	1·01	·99	·97	·95	·93	·92	·90	·88	32
33	1·30	1·26	1·23	1·19	1·16	1·13	1·11	1·08	1·05	1·03	1·01	·99	·97	·95	·93	·92	33
34	1·35	1·31	1·27	1·24	1·21	1·18	1·15	1·12	1·10	1·07	1·05	1·03	1·01	·99	·97	·96	34
35	1·40	1·36	1·32	1·29	1·25	1·22	1·19	1·16	1·14	1·11	1·09	1·07	1·05	1·03	1·01	·99	35
36	1·45	1·41	1·37	1·33	1·30	1·27	1·24	1·21	1·18	1·15	1·13	1·11	1·09	1·07	1·05	1·03	36
37	1·51	1·46	1·42	1·38	1·35	1·31	1·28	1·25	1·22	1·20	1·17	1·15	1·13	1·10	1·08	1·07	37
38	1·56	1·52	1·47	1·43	1·40	1·36	1·33	1·30	1·27	1·24	1·22	1·19	1·17	1·15	1·12	1·11	38
39	1·62	1·57	1·53	1·49	1·45	1·41	1·38	1·35	1·32	1·29	1·26	1·23	1·21	1·19	1·17	1·15	39
40	1·68	1·63	1·58	1·54	1·50	1·46	1·43	1·39	1·36	1·33	1·31	1·28	1·25	1·23	1·21	1·19	40
41	1·74	1·69	1·64	1·60	1·55	1·52	1·48	1·44	1·41	1·38	1·35	1·33	1·30	1·27	1·25	1·23	41
42	1·80	1·75	1·70	1·65	1·61	1·57	1·53	1·50	1·46	1·43	1·40	1·37	1·35	1·32	1·30	1·28	42
43	1·87	1·81	1·76	1·71	1·67	1·63	1·59	1·55	1·51	1·48	1·45	1·42	1·39	1·37	1·34	1·32	43
44	1·93	1·87	1·82	1·77	1·73	1·68	1·64	1·60	1·57	1·53	1·50	1·47	1·44	1·42	1·39	1·37	44
45	2·00	1·94	1·89	1·84	1·79	1·74	1·70	1·66	1·62	1·59	1·56	1·52	1·49	1·47	1·44	1·41	45
46	2·07	2·01	1·95	1·90	1·85	1·81	1·76	1·72	1·68	1·65	1·61	1·58	1·55	1·52	1·49	1·47	46
47	2·14	2·08	2·02	1·97	1·92	1·87	1·82	1·78	1·74	1·70	1·67	1·63	1·60	1·57	1·54	1·52	47
48	2·22	2·16	2·10	2·04	1·99	1·94	1·89	1·85	1·80	1·76	1·73	1·69	1·66	1·63	1·60	1·57	48
49	2·30	2·23	2·17	2·11	2·06	2·01	1·96	1·91	1·87	1·83	1·79	1·75	1·72	1·69	1·66	1·63	49
50	2·38	2·31	2·25	2·19	2·13	2·08	2·03	1·98	1·94	1·89	1·85	1·82	1·78	1·75	1·72	1·69	50
51	2·47	2·40	2·33	2·27	2·21	2·15	2·10	2·05	2·01	1·96	1·92	1·88	1·85	1·81	1·78	1·75	51
52	2·56	2·49	2·42	2·35	2·29	2·23	2·18	2·13	2·08	2·03	1·99	1·95	1·91	1·88	1·84	1·81	52
53	2·65	2·58	2·50	2·44	2·37	2·31	2·26	2·21	2·16	2·11	2·06	2·02	1·98	1·95	1·91	1·88	53
54	2·75	2·67	2·60	2·53	2·46	2·40	2·34	2·29	2·24	2·19	2·14	2·10	2·06	2·02	1·98	1·95	54
55	2·86	2·77	2·70	2·62	2·55	2·49	2·43	2·37	2·32	2·27	2·22	2·18	2·13	2·09	2·06	2·02	55
56	2·97	2·88	2·80	2·72	2·65	2·58	2·52	2·46	2·41	2·36	2·31	2·26	2·22	2·17	2·13	2·10	56
57	3·08	2·99	2·91	2·83	2·75	2·68	2·62	2·56	2·50	2·45	2·40	2·35	2·30	2·26	2·22	2·18	57
58	3·20	3·11	3·02	2·94	2·86	2·79	2·72	2·66	2·60	2·54	2·49	2·44	2·39	2·35	2·30	2·27	58
59	3·33	3·23	3·14	3·06	2·98	2·90	2·83	2·77	2·70	2·64	2·59	2·54	2·49	2·44	2·40	2·36	59
60	3·46	3·36	3·27	3·18	3·10	3·02	2·95	2·88	2·81	2·75	2·69	2·64	2·59	2·54	2·49	2·45	60
Dec	150°	149°	148°	147°	146°	145°	144°	143°	142°	141°	140°	139°	138°	137°	136°	135°	Dec
	210°	211°	212°	213°	214°	215°	216°	217°	218°	219°	220°	221°	222°	223°	224°	225°	

B - Always named the same as Declination

B - Always named the same as Declination

B

TABLE A HOUR ANGLE

A - Named opposite to Latitude, except when Hour Angle is between 90° and 270°

Lat °	45° 315°	46° 314°	47° 313°	48° 312°	49° 311°	50° 310°	51° 309°	52° 308°	53° 307°	54° 306°	55° 305°	56° 304°	57° 303°	58° 302°	59° 301°	60° 300°	Lat °
0	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	0
1	-02	-02	-02	-02	-02	-01	-01	-01	-01	-01	-01	-01	-01	-01	-01	-01	1
2	-03	-03	-03	-03	-03	-03	-03	-03	-03	-03	-02	-02	-02	-02	-02	-02	2
3	-05	-05	-05	-05	-05	-04	-04	-04	-04	-04	-04	-04	-03	-03	-03	-03	3
4	-07	-07	-07	-06	-06	-06	-05	-05	-05	-05	-05	-05	-04	-04	-04	-04	4
5	-09	-08	-08	-08	-08	-07	-07	-07	-07	-06	-06	-06	-06	-05	-05	-05	5
6	-11	-10	-10	-09	-09	-09	-09	-08	-08	-08	-07	-07	-07	-07	-06	-06	6
7	-12	-12	-11	-11	-11	-10	-10	-10	-09	-09	-09	-08	-08	-08	-07	-07	7
8	-14	-14	-13	-13	-12	-12	-11	-11	-11	-10	-10	-09	-09	-09	-08	-08	8
9	-16	-15	-15	-14	-14	-13	-13	-12	-12	-11	-11	-10	-10	-10	-09	-09	9
10	-18	-17	-16	-16	-15	-15	-14	-14	-13	-13	-12	-12	-11	-11	-11	-10	10
11	-19	-19	-18	-18	-17	-16	-16	-15	-15	-14	-14	-13	-13	-12	-12	-11	11
12	-21	-21	-20	-19	-18	-18	-17	-17	-16	-15	-15	-14	-14	-13	-13	-12	12
13	-23	-22	-22	-21	-20	-19	-19	-18	-17	-17	-16	-16	-15	-14	-14	-13	13
14	-25	-24	-23	-22	-22	-21	-20	-19	-19	-18	-17	-17	-16	-16	-15	-14	14
15	-27	-26	-25	-24	-23	-22	-22	-21	-20	-19	-19	-18	-17	-17	-16	-15	15
16	-29	-28	-27	-26	-25	-24	-23	-22	-22	-21	-20	-19	-19	-18	-17	-17	16
17	-31	-30	-29	-28	-27	-26	-25	-24	-23	-22	-21	-21	-20	-19	-18	-18	17
18	-32	-31	-30	-29	-28	-27	-26	-25	-24	-24	-23	-22	-21	-20	-20	-19	18
19	-34	-33	-32	-31	-30	-29	-28	-27	-26	-25	-24	-23	-22	-22	-21	-20	19
20	-36	-35	-34	-33	-32	-31	-29	-28	-27	-26	-25	-25	-24	-23	-22	-21	20
21	-38	-37	-36	-35	-33	-32	-31	-30	-29	-28	-27	-26	-25	-24	-23	-22	21
22	-40	-39	-38	-36	-35	-34	-33	-32	-30	-29	-28	-27	-26	-25	-24	-23	22
23	-42	-41	-40	-38	-37	-36	-34	-33	-32	-31	-30	-29	-28	-27	-26	-25	23
24	-45	-43	-42	-40	-39	-37	-36	-35	-34	-32	-31	-30	-29	-28	-27	-26	24
25	-47	-45	-44	-42	-41	-39	-38	-36	-35	-34	-33	-31	-30	-29	-28	-27	25
26	-49	-47	-46	-44	-42	-41	-39	-38	-37	-35	-34	-33	-32	-30	-29	-28	26
27	-51	-49	-48	-46	-44	-43	-41	-40	-38	-37	-36	-34	-33	-32	-31	-29	27
28	-53	-51	-50	-48	-46	-45	-43	-42	-40	-39	-37	-36	-35	-33	-32	-31	28
29	-55	-54	-52	-50	-48	-47	-45	-43	-42	-40	-39	-37	-36	-35	-33	-32	29
30	-58	-56	-54	-52	-50	-48	-47	-45	-44	-42	-40	-39	-37	-36	-35	-33	30
31	-60	-58	-56	-54	-52	-50	-49	-47	-45	-44	-42	-40	-39	-38	-36	-35	31
32	-62	-60	-58	-56	-54	-52	-51	-49	-47	-45	-44	-42	-41	-39	-38	-36	32
33	-65	-63	-61	-58	-56	-55	-53	-51	-49	-47	-45	-44	-42	-41	-39	-37	33
34	-67	-65	-63	-61	-59	-57	-55	-53	-51	-49	-47	-46	-44	-42	-41	-39	34
35	-70	-68	-65	-63	-61	-59	-57	-55	-53	-51	-49	-47	-45	-44	-42	-40	35
36	-73	-70	-68	-65	-63	-61	-59	-57	-55	-53	-51	-49	-47	-45	-44	-42	36
37	-75	-73	-70	-68	-66	-63	-61	-59	-57	-55	-53	-51	-49	-47	-45	-44	37
38	-78	-75	-73	-70	-68	-66	-63	-61	-59	-57	-55	-53	-51	-49	-47	-45	38
39	-81	-78	-76	-73	-70	-68	-66	-63	-61	-59	-57	-55	-53	-51	-49	-47	39
40	-84	-81	-78	-76	-73	-70	-68	-66	-63	-61	-59	-57	-55	-52	-50	-48	40
41	-87	-84	-81	-78	-76	-73	-70	-68	-66	-63	-61	-59	-56	-54	-52	-50	41
42	-90	-87	-84	-81	-78	-76	-73	-70	-68	-65	-63	-61	-58	-56	-54	-52	42
43	-93	-90	-87	-84	-81	-78	-76	-73	-70	-68	-65	-63	-61	-58	-56	-54	43
44	-97	-93	-90	-87	-84	-81	-78	-75	-73	-70	-68	-65	-63	-60	-58	-56	44
45	1-00	-97	-93	-90	-87	-84	-81	-78	-75	-73	-70	-68	-65	-63	-60	-58	45
46	1-04	1-00	-97	-93	-90	-87	-84	-81	-78	-75	-73	-70	-67	-65	-62	-60	46
47	1-07	1-04	1-00	-97	-93	-90	-87	-84	-81	-78	-75	-72	-70	-67	-64	-62	47
48	1-11	1-07	1-04	1-00	-97	-93	-90	-87	-84	-81	-78	-75	-72	-69	-67	-64	48
49	1-15	1-11	1-07	1-04	1-00	-97	-93	-90	-87	-84	-81	-78	-75	-72	-69	-66	49
50	1-19	1-15	1-11	1-07	1-04	1-00	-97	-93	-90	-87	-83	-80	-77	-75	-72	-69	50
51	1-23	1-19	1-15	1-11	1-07	1-04	1-00	-97	-93	-90	-86	-83	-80	-77	-74	-71	51
52	1-28	1-24	1-19	1-15	1-11	1-07	1-04	1-00	-96	-93	-90	-86	-83	-80	-77	-74	52
53	1-33	1-28	1-24	1-19	1-15	1-11	1-07	1-04	1-00	-96	-93	-90	-86	-83	-80	-77	53
54	1-38	1-33	1-28	1-24	1-20	1-15	1-11	1-08	1-04	1-00	-96	-93	-89	-86	-83	-79	54
55	1-43	1-38	1-33	1-29	1-24	1-20	1-16	1-12	1-08	1-04	1-00	-96	-93	-89	-86	-82	55
56	1-48	1-43	1-38	1-34	1-29	1-24	1-20	1-16	1-12	1-08	1-04	1-00	-96	-93	-89	-86	56
57	1-54	1-49	1-44	1-39	1-34	1-29	1-25	1-20	1-16	1-12	1-08	1-04	1-00	-96	-93	-89	57
58	1-60	1-55	1-49	1-44	1-39	1-34	1-30	1-25	1-21	1-16	1-12	1-08	1-04	1-00	-96	-92	58
59	1-66	1-61	1-55	1-50	1-45	1-40	1-35	1-30	1-25	1-21	1-17	1-12	1-08	1-04	1-00	-96	59
60	1-73	1-67	1-62	1-56	1-51	1-45	1-40	1-35	1-31	1-26	1-21	1-17	1-12	1-08	1-04	1-00	60
Lat	135° 225°	134° 226°	133° 227°	132° 228°	131° 229°	130° 230°	129° 231°	128° 232°	127° 233°	126° 234°	125° 235°	124° 236°	123° 237°	122° 238°	121° 239°	120° 240°	Lat

HOUR ANGLE

A - Named opposite to Latitude, except when Hour Angle is between 90° and 270°

TABLE B HOUR ANGLE

Dec °	45° 46°	47° 48°	49° 50°	51° 52°	53° 54°	55° 56°	57° 58°	59° 60°	Dec °
	315° 314°	313° 312°	311° 310°	309° 308°	307° 306°	305° 304°	303° 302°	301° 300°	
0	·00	·00	·00	·00	·00	·00	·00	·00	0
1	·02	·02	·02	·02	·02	·02	·02	·02	1
2	·05	·05	·05	·05	·04	·04	·04	·04	2
3	·07	·07	·07	·07	·07	·06	·06	·06	3
4	·10	·10	·10	·09	·09	·09	·08	·08	4
5	·12	·12	·12	·11	·11	·11	·10	·10	5
6	·15	·15	·14	·14	·13	·13	·13	·12	6
7	·17	·17	·17	·16	·16	·15	·15	·14	7
8	·20	·20	·19	·19	·18	·17	·17	·16	8
9	·22	·22	·22	·21	·20	·19	·19	·18	9
10	·25	·25	·24	·23	·22	·22	·21	·21	10
11	·27	·27	·26	·26	·24	·24	·23	·23	11
12	·30	·30	·29	·28	·27	·26	·25	·25	12
13	·33	·32	·31	·30	·29	·28	·27	·27	13
14	·35	·35	·34	·33	·32	·31	·30	·29	14
15	·38	·37	·36	·35	·34	·33	·32	·31	15
16	·41	·40	·39	·38	·37	·36	·35	·34	16
17	·43	·43	·42	·41	·40	·39	·38	·36	17
18	·46	·45	·44	·43	·42	·41	·40	·39	18
19	·49	·48	·47	·46	·45	·44	·43	·42	19
20	·51	·51	·50	·49	·48	·47	·46	·45	20
21	·54	·53	·52	·51	·50	·49	·48	·47	21
22	·57	·56	·55	·54	·53	·52	·51	·50	22
23	·60	·59	·58	·57	·56	·55	·54	·53	23
24	·63	·62	·61	·60	·59	·58	·57	·56	24
25	·66	·65	·64	·63	·62	·61	·60	·59	25
26	·69	·68	·67	·66	·65	·64	·63	·62	26
27	·72	·71	·70	·69	·68	·67	·66	·65	27
28	·75	·74	·73	·72	·71	·70	·69	·68	28
29	·78	·77	·76	·75	·74	·73	·72	·71	29
30	·82	·80	·79	·78	·77	·76	·75	·74	30
31	·85	·84	·83	·82	·81	·80	·79	·78	31
32	·88	·87	·86	·85	·84	·83	·82	·81	32
33	·92	·90	·89	·88	·87	·86	·85	·84	33
34	·96	·94	·92	·91	·90	·89	·88	·87	34
35	·99	·97	·96	·94	·93	·91	·90	·89	35
36	1·03	1·01	·99	·98	·96	·95	·93	·92	36
37	1·07	1·05	1·03	1·01	1·00	·98	·97	·96	37
38	1·11	1·09	1·07	1·05	1·04	1·02	1·00	·99	38
39	1·15	1·13	1·11	1·09	1·07	1·06	1·04	1·03	39
40	1·19	1·17	1·15	1·13	1·11	1·10	1·08	1·06	40
41	1·23	1·21	1·19	1·17	1·15	1·13	1·12	1·10	41
42	1·28	1·25	1·23	1·21	1·19	1·18	1·16	1·14	42
43	1·32	1·30	1·28	1·25	1·24	1·22	1·20	1·18	43
44	1·37	1·34	1·32	1·30	1·28	1·26	1·24	1·23	44
45	1·41	1·39	1·37	1·35	1·33	1·31	1·29	1·27	45
46	1·47	1·44	1·42	1·39	1·37	1·35	1·33	1·31	46
47	1·52	1·49	1·47	1·44	1·42	1·40	1·38	1·36	47
48	1·57	1·54	1·52	1·49	1·47	1·45	1·43	1·41	48
49	1·63	1·60	1·57	1·55	1·52	1·50	1·48	1·46	49
50	1·69	1·66	1·63	1·60	1·58	1·56	1·53	1·51	50
51	1·75	1·72	1·69	1·66	1·64	1·61	1·59	1·57	51
52	1·81	1·78	1·75	1·72	1·70	1·67	1·65	1·62	52
53	1·88	1·84	1·81	1·79	1·76	1·73	1·71	1·68	53
54	1·95	1·91	1·88	1·85	1·82	1·80	1·77	1·75	54
55	2·02	1·99	1·95	1·92	1·89	1·86	1·84	1·81	55
56	2·10	2·06	2·03	2·00	1·96	1·94	1·91	1·88	56
57	2·18	2·14	2·11	2·07	2·04	2·01	1·98	1·95	57
58	2·27	2·22	2·19	2·15	2·12	2·09	2·06	2·03	58
59	2·36	2·31	2·28	2·24	2·21	2·17	2·14	2·11	59
60	2·45	2·41	2·37	2·33	2·29	2·26	2·23	2·20	60
Dec	135° 134°	133° 132°	131° 130°	129° 128°	127° 126°	125° 124°	123° 122°	121° 120°	Dec
	225° 226°	227° 228°	229° 230°	231° 232°	233° 234°	235° 236°	237° 238°	239° 240°	

HOUR ANGLE

B - Always named the same as Declination

B - Always named the same as Declination

B

TABLE A HOUR ANGLE

A - Named opposite to Latitude, except when Hour Angle is between 90° and 270°

Lat. °	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	72°	73°	74°	75°	Lat. °
	300°	299°	298°	297°	296°	295°	294°	293°	292°	291°	290°	289°	288°	287°	286°	285°	
0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	0
1	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	1
2	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	2
3	.03	.03	.03	.03	.03	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	3
4	.04	.04	.04	.04	.03	.03	.03	.03	.03	.03	.03	.02	.02	.02	.02	.02	4
5	.05	.05	.05	.04	.04	.04	.04	.04	.04	.03	.03	.03	.03	.03	.03	.02	5
6	.06	.06	.06	.05	.05	.05	.05	.05	.04	.04	.04	.04	.03	.03	.03	.03	6
7	.07	.07	.07	.06	.06	.06	.06	.05	.05	.05	.05	.04	.04	.04	.04	.03	7
8	.08	.08	.07	.07	.07	.07	.06	.06	.06	.05	.05	.05	.05	.04	.04	.04	8
9	.09	.09	.08	.08	.08	.08	.07	.07	.06	.06	.06	.06	.05	.05	.05	.04	9
10	.10	.10	.09	.09	.09	.08	.08	.08	.07	.07	.06	.06	.06	.05	.05	.05	10
11	.11	.11	.10	.10	.10	.09	.09	.08	.08	.08	.07	.07	.06	.06	.06	.05	11
12	.12	.12	.11	.11	.10	.10	.10	.09	.09	.09	.08	.07	.07	.07	.06	.06	12
13	.13	.13	.12	.12	.11	.11	.10	.10	.09	.09	.08	.08	.08	.07	.07	.06	13
14	.14	.14	.13	.13	.12	.12	.11	.11	.10	.10	.09	.09	.08	.08	.07	.07	14
15	.15	.15	.14	.14	.13	.12	.12	.11	.11	.10	.10	.09	.09	.08	.08	.07	15
16	.17	.16	.15	.15	.14	.13	.13	.12	.12	.11	.10	.10	.09	.09	.08	.08	16
17	.18	.17	.16	.16	.15	.14	.14	.13	.12	.12	.11	.11	.10	.09	.09	.08	17
18	.19	.18	.17	.17	.16	.15	.15	.14	.13	.13	.12	.11	.11	.10	.09	.09	18
19	.20	.19	.18	.18	.17	.16	.15	.15	.14	.13	.12	.12	.11	.11	.10	.09	19
20	.21	.20	.19	.19	.18	.17	.16	.15	.15	.14	.13	.13	.12	.11	.10	.10	20
21	.22	.21	.20	.20	.19	.18	.17	.16	.16	.15	.14	.13	.13	.12	.11	.10	21
22	.23	.22	.21	.21	.20	.19	.18	.17	.16	.16	.15	.14	.13	.12	.12	.11	22
23	.25	.24	.23	.22	.21	.20	.19	.18	.17	.16	.15	.15	.14	.13	.12	.11	23
24	.26	.25	.24	.23	.22	.21	.20	.19	.18	.17	.16	.15	.15	.14	.13	.12	24
25	.27	.26	.25	.24	.23	.22	.21	.20	.19	.18	.17	.16	.15	.14	.13	.13	25
26	.28	.27	.26	.25	.24	.23	.22	.21	.20	.19	.18	.17	.16	.15	.14	.13	26
27	.29	.28	.27	.26	.25	.24	.23	.22	.21	.20	.19	.18	.17	.16	.15	.14	27
28	.31	.29	.28	.27	.26	.25	.24	.23	.22	.20	.19	.18	.17	.16	.15	.14	28
29	.32	.31	.29	.28	.27	.26	.25	.24	.22	.21	.20	.19	.18	.17	.16	.15	29
30	.33	.32	.31	.29	.28	.27	.26	.25	.23	.22	.21	.20	.19	.18	.17	.16	30
31	.35	.33	.32	.31	.29	.28	.27	.26	.24	.23	.22	.21	.20	.18	.17	.16	31
32	.36	.35	.33	.32	.31	.29	.28	.27	.25	.24	.23	.22	.20	.19	.18	.17	32
33	.37	.36	.35	.33	.32	.30	.29	.28	.26	.25	.24	.22	.21	.20	.19	.17	33
34	.39	.37	.36	.34	.33	.31	.30	.29	.27	.26	.25	.23	.22	.21	.19	.18	34
35	.40	.39	.37	.36	.34	.33	.31	.30	.28	.27	.26	.24	.23	.21	.20	.19	35
36	.42	.40	.39	.37	.35	.34	.32	.31	.29	.28	.26	.25	.24	.22	.21	.20	36
37	.44	.42	.40	.38	.37	.35	.34	.32	.30	.29	.27	.26	.25	.23	.22	.20	37
38	.45	.43	.42	.40	.38	.36	.35	.33	.32	.30	.28	.27	.25	.24	.22	.21	38
39	.47	.45	.43	.41	.40	.38	.36	.34	.33	.31	.30	.28	.26	.25	.23	.22	39
40	.48	.47	.45	.43	.41	.39	.37	.36	.34	.32	.31	.29	.27	.26	.24	.23	40
41	.50	.48	.46	.44	.42	.41	.39	.37	.35	.33	.32	.30	.28	.27	.25	.23	41
42	.52	.50	.48	.46	.44	.42	.40	.38	.36	.35	.33	.31	.29	.28	.26	.24	42
43	.54	.52	.50	.48	.46	.43	.42	.40	.38	.36	.34	.32	.30	.29	.27	.25	43
44	.56	.54	.51	.49	.47	.45	.43	.41	.39	.37	.35	.33	.31	.30	.28	.26	44
45	.58	.55	.53	.51	.49	.47	.45	.42	.40	.38	.36	.34	.33	.31	.29	.27	45
46	.60	.57	.55	.53	.51	.48	.46	.44	.42	.40	.38	.36	.34	.32	.30	.28	46
47	.62	.59	.57	.55	.52	.50	.48	.45	.43	.41	.39	.37	.35	.33	.31	.29	47
48	.64	.62	.59	.57	.54	.52	.49	.47	.45	.43	.40	.38	.36	.34	.32	.30	48
49	.66	.64	.61	.59	.56	.54	.51	.49	.47	.44	.42	.40	.37	.35	.33	.31	49
50	.69	.66	.63	.61	.58	.56	.53	.51	.48	.46	.43	.41	.39	.36	.34	.32	50
51	.71	.68	.66	.63	.60	.58	.55	.52	.50	.47	.45	.43	.40	.38	.35	.33	51
52	.74	.71	.68	.65	.62	.60	.57	.54	.52	.49	.47	.44	.42	.39	.37	.34	52
53	.77	.74	.71	.68	.65	.62	.59	.56	.54	.51	.48	.46	.43	.41	.38	.36	53
54	.79	.76	.73	.70	.67	.64	.61	.58	.56	.53	.50	.47	.45	.42	.40	.37	54
55	.82	.79	.76	.73	.70	.67	.64	.61	.58	.55	.52	.49	.46	.44	.41	.38	55
56	.86	.82	.79	.76	.72	.69	.66	.63	.60	.57	.54	.51	.48	.45	.43	.40	56
57	.89	.85	.82	.78	.75	.72	.69	.65	.62	.59	.56	.53	.50	.47	.44	.41	57
58	.92	.89	.85	.81	.78	.75	.71	.68	.65	.61	.58	.55	.52	.49	.46	.43	58
59	.96	.92	.88	.85	.81	.78	.74	.71	.67	.64	.61	.57	.54	.51	.48	.45	59
60	1.00	.96	.92	.88	.85	.81	.77	.74	.70	.67	.63	.60	.56	.53	.50	.46	60
Lat	120°	119°	118°	117°	116°	115°	114°	113°	112°	111°	110°	109°	108°	107°	106°	105°	Lat
	240°	241°	242°	243°	244°	245°	246°	247°	248°	249°	250°	251°	252°	253°	254°	255°	

HOUR ANGLE

A - Named opposite to Latitude, except when Hour Angle is between 90° and 270°

TABLE B HOUR ANGLE

B - Always named the same as Declination

B - Always named the same as Declination

Dec °	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	72°	73°	74°	75°	Dec °
	300°	299°	298°	297°	296°	295°	294°	293°	292°	291°	290°	289°	288°	287°	286°	285°	
0	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	·00	0
1	·02	·02	·02	·02	·02	·02	·02	·02	·02	·02	·02	·02	·02	·02	·02	·02	1
2	·04	·04	·04	·04	·04	·04	·04	·04	·04	·04	·04	·04	·04	·04	·04	·04	2
3	·06	·06	·06	·06	·06	·06	·06	·06	·06	·06	·06	·06	·06	·06	·06	·05	3
4	·08	·08	·08	·08	·08	·08	·08	·08	·08	·08	·07	·07	·07	·07	·07	·07	4
5	·10	·10	·10	·10	·10	·10	·10	·10	·09	·09	·09	·09	·09	·09	·09	·09	5
6	·12	·12	·12	·12	·12	·12	·12	·11	·11	·11	·11	·11	·11	·11	·11	·11	6
7	·14	·14	·14	·14	·14	·14	·13	·13	·13	·13	·13	·13	·13	·13	·13	·13	7
8	·16	·16	·16	·16	·16	·16	·15	·15	·15	·15	·15	·15	·15	·15	·15	·15	8
9	·18	·18	·18	·18	·18	·17	·17	·17	·17	·17	·17	·17	·17	·17	·16	·16	9
10	·20	·20	·20	·20	·20	·19	·19	·19	·19	·19	·19	·19	·19	·18	·18	·18	10
11	·22	·22	·22	·22	·22	·21	·21	·21	·21	·21	·21	·21	·20	·20	·20	·20	11
12	·25	·24	·24	·24	·24	·23	·23	·23	·23	·23	·23	·23	·22	·22	·22	·22	12
13	·27	·26	·26	·26	·26	·25	·25	·25	·25	·25	·25	·24	·24	·24	·24	·24	13
14	·29	·29	·28	·28	·28	·28	·27	·27	·27	·27	·27	·26	·26	·26	·26	·26	14
15	·31	·31	·30	·30	·30	·30	·29	·29	·29	·29	·29	·28	·28	·28	·28	·28	15
16	·33	·33	·32	·32	·32	·32	·31	·31	·31	·31	·31	·30	·30	·30	·30	·30	16
17	·35	·35	·35	·34	·34	·34	·33	·33	·33	·33	·33	·32	·32	·32	·32	·32	17
18	·38	·37	·37	·36	·36	·36	·36	·35	·35	·35	·35	·34	·34	·34	·34	·34	18
19	·40	·39	·39	·39	·38	·38	·38	·37	·37	·37	·37	·36	·36	·36	·36	·36	19
20	·42	·42	·41	·41	·41	·40	·40	·40	·39	·39	·39	·39	·38	·38	·38	·38	20
21	·44	·44	·43	·43	·43	·42	·42	·42	·41	·41	·41	·41	·40	·40	·40	·40	21
22	·47	·46	·46	·45	·45	·45	·44	·44	·44	·43	·43	·43	·43	·42	·42	·42	22
23	·49	·49	·48	·48	·47	·47	·46	·46	·46	·46	·45	·45	·45	·44	·44	·44	23
24	·51	·51	·50	·50	·50	·49	·49	·48	·48	·48	·47	·47	·47	·47	·46	·46	24
25	·54	·53	·53	·52	·52	·52	·51	·51	·50	·50	·49	·49	·49	·49	·49	·48	25
26	·56	·56	·55	·55	·54	·54	·53	·53	·53	·52	·52	·52	·51	·51	·51	·50	26
27	·59	·58	·58	·57	·57	·56	·56	·55	·55	·55	·54	·54	·54	·53	·53	·53	27
28	·61	·61	·60	·60	·59	·59	·58	·58	·57	·57	·57	·56	·56	·56	·55	·55	28
29	·64	·63	·63	·62	·62	·61	·61	·60	·60	·59	·59	·59	·58	·58	·58	·57	29
30	·67	·66	·65	·65	·64	·64	·63	·63	·62	·62	·62	·61	·61	·60	·60	·60	30
31	·69	·69	·68	·67	·67	·66	·66	·65	·65	·64	·64	·64	·63	·63	·63	·62	31
32	·72	·71	·71	·70	·70	·69	·68	·68	·67	·67	·67	·66	·66	·65	·65	·65	32
33	·75	·74	·74	·73	·72	·72	·71	·71	·70	·70	·69	·69	·68	·68	·68	·67	33
34	·78	·77	·76	·76	·75	·75	·74	·73	·73	·72	·72	·71	·71	·71	·70	·70	34
35	·81	·80	·79	·79	·78	·77	·77	·76	·76	·75	·74	·74	·74	·73	·73	·72	35
36	·84	·83	·82	·82	·81	·80	·80	·79	·78	·78	·77	·77	·76	·76	·76	·75	36
37	·87	·86	·85	·85	·84	·83	·82	·82	·81	·81	·80	·80	·79	·79	·78	·78	37
38	·90	·89	·88	·88	·87	·86	·86	·85	·84	·84	·83	·83	·82	·82	·81	·81	38
39	·94	·93	·92	·91	·90	·89	·89	·88	·87	·87	·86	·86	·85	·85	·84	·84	39
40	·97	·96	·95	·94	·93	·93	·92	·91	·91	·90	·89	·89	·88	·88	·87	·87	40
41	1·00	·99	·98	·98	·97	·96	·95	·94	·94	·93	·92	·92	·91	·91	·90	·90	41
42	1·04	1·03	1·02	1·01	1·00	·99	·99	·98	·97	·96	·96	·95	·95	·94	·94	·93	42
43	1·08	1·07	1·06	1·05	1·04	1·03	1·02	1·01	1·01	1·00	·99	·99	·98	·98	·97	·97	43
44	1·11	1·10	1·09	1·08	1·07	1·07	1·06	1·05	1·04	1·03	1·03	1·02	1·02	1·01	1·00	1·00	44
45	1·15	1·14	1·13	1·12	1·11	1·10	1·10	1·09	1·08	1·07	1·06	1·06	1·05	1·05	1·04	1·04	45
46	1·20	1·18	1·17	1·16	1·15	1·14	1·13	1·12	1·12	1·11	1·10	1·10	1·09	1·08	1·08	1·07	46
47	1·24	1·23	1·22	1·20	1·19	1·18	1·17	1·16	1·16	1·15	1·14	1·13	1·13	1·12	1·12	1·11	47
48	1·28	1·27	1·26	1·25	1·24	1·22	1·22	1·21	1·20	1·19	1·18	1·17	1·17	1·16	1·16	1·15	48
49	1·33	1·32	1·30	1·29	1·28	1·27	1·26	1·25	1·24	1·23	1·22	1·22	1·20	1·20	1·20	1·19	49
50	1·38	1·36	1·35	1·34	1·33	1·31	1·31	1·29	1·29	1·28	1·27	1·26	1·25	1·25	1·24	1·23	50
51	1·43	1·41	1·40	1·39	1·37	1·36	1·35	1·34	1·33	1·32	1·31	1·31	1·30	1·29	1·28	1·28	51
52	1·48	1·46	1·45	1·44	1·42	1·41	1·40	1·39	1·38	1·37	1·36	1·35	1·35	1·34	1·33	1·33	52
53	1·53	1·52	1·50	1·49	1·48	1·46	1·45	1·44	1·43	1·42	1·41	1·40	1·40	1·39	1·38	1·37	53
54	1·59	1·57	1·56	1·55	1·53	1·52	1·51	1·50	1·48	1·47	1·46	1·46	1·45	1·44	1·43	1·42	54
55	1·65	1·63	1·62	1·60	1·59	1·58	1·56	1·55	1·54	1·53	1·52	1·51	1·50	1·49	1·49	1·48	55
56	1·71	1·70	1·68	1·66	1·65	1·64	1·62	1·61	1·60	1·59	1·58	1·57	1·56	1·55	1·54	1·54	56
57	1·78	1·76	1·74	1·73	1·71	1·70	1·69	1·67	1·66	1·65	1·64	1·63	1·62	1·61	1·60	1·60	57
58	1·85	1·83	1·81	1·80	1·78	1·77	1·75	1·74	1·73	1·71	1·71	1·69	1·68	1·67	1·66	1·66	58
59	1·92	1·90	1·89	1·87	1·85	1·84	1·82	1·81	1·79	1·78	1·77	1·76	1·75	1·74	1·73	1·72	59
60	2·00	1·98	1·96	1·94	1·93	1·91	1·89	1·88	1·87	1·86	1·84	1·83	1·82	1·81	1·80	1·79	60
Dec.	120°	119°	118°	117°	116°	115°	114°	113°	112°	111°	110°	109°	108°	107°	106°	105°	Dec.
	240°	241°	242°	243°	244°	245°	246°	247°	248°	249°	250°	251°	252°	253°	254°	255°	
HOUR ANGLE																	

B

TABLE A HOUR ANGLE

A - Named opposite to Latitude, except when Hour Angle is between 90° and 270°

Lat °	75°	76°	77°	78°	79°	80°	81°	82°	83°	84°	85°	86°	87°	88°	89°	90°	Lat °
	285°	284°	283°	282°	281°	280°	279°	278°	277°	276°	275°	274°	273°	272°	271°	270°	
0	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	0
1	-01	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	1
2	-01	-01	-01	-01	-01	-01	-01	-01	-00	-00	-00	-00	-00	-00	-00	-00	2
3	-01	-01	-01	-01	-01	-01	-01	-01	-01	-01	-01	-00	-00	-00	-00	-00	3
4	-02	-02	-02	-02	-01	-01	-01	-01	-01	-01	-01	-01	-00	-00	-00	-00	4
5	-02	-02	-02	-02	-02	-02	-01	-01	-01	-01	-01	-01	-01	-00	-00	-00	5
6	-03	-03	-02	-02	-02	-02	-02	-02	-01	-01	-01	-01	-01	-00	-00	-00	6
7	-03	-03	-03	-03	-02	-02	-02	-02	-02	-01	-01	-01	-01	-00	-00	-00	7
8	-04	-04	-03	-03	-03	-03	-02	-02	-02	-02	-01	-01	-01	-01	-00	-00	8
9	-04	-04	-04	-03	-03	-03	-03	-02	-02	-02	-01	-01	-01	-01	-00	-00	9
10	-05	-04	-04	-04	-03	-03	-03	-03	-02	-02	-02	-01	-01	-01	-00	-00	10
11	-05	-05	-05	-04	-04	-03	-03	-03	-02	-02	-02	-01	-01	-01	-00	-00	11
12	-06	-05	-05	-05	-04	-04	-03	-03	-03	-02	-02	-02	-01	-01	-00	-00	12
13	-06	-06	-05	-05	-05	-04	-04	-03	-03	-02	-02	-02	-01	-01	-00	-00	13
14	-07	-06	-06	-05	-05	-04	-04	-04	-03	-03	-02	-02	-01	-01	-00	-00	14
15	-07	-07	-06	-06	-05	-05	-04	-04	-03	-03	-02	-02	-01	-01	-01	-00	15
16	-08	-07	-07	-06	-06	-05	-05	-04	-04	-03	-03	-02	-02	-01	-01	-00	16
17	-08	-08	-07	-07	-06	-05	-05	-04	-04	-03	-03	-02	-02	-01	-01	-00	17
18	-09	-08	-08	-07	-06	-06	-05	-05	-04	-03	-03	-02	-02	-01	-01	-00	18
19	-09	-09	-08	-07	-07	-06	-06	-05	-04	-04	-03	-02	-02	-01	-01	-00	19
20	-10	-09	-08	-08	-07	-06	-06	-05	-05	-04	-03	-03	-02	-01	-01	-00	20
21	-10	-10	-09	-08	-07	-07	-06	-05	-05	-04	-03	-03	-02	-01	-01	-00	21
22	-11	-10	-09	-09	-08	-07	-06	-06	-05	-04	-04	-03	-02	-01	-01	-00	22
23	-11	-11	-10	-09	-08	-08	-07	-06	-05	-05	-04	-03	-02	-02	-01	-00	23
24	-12	-11	-10	-10	-09	-08	-07	-06	-06	-05	-04	-03	-02	-02	-01	-00	24
25	-13	-12	-11	-10	-09	-08	-07	-07	-06	-05	-04	-03	-02	-02	-01	-00	25
26	-13	-12	-11	-10	-10	-09	-08	-07	-06	-05	-04	-03	-03	-02	-01	-00	26
27	-14	-13	-12	-11	-10	-09	-08	-07	-06	-05	-05	-04	-03	-02	-01	-00	27
28	-14	-13	-12	-11	-10	-09	-08	-08	-07	-06	-05	-04	-03	-02	-01	-00	28
29	-15	-14	-13	-12	-11	-10	-09	-08	-07	-06	-05	-04	-03	-02	-01	-00	29
30	-16	-14	-13	-12	-11	-10	-09	-08	-07	-06	-05	-04	-03	-02	-01	-00	30
31	-16	-15	-14	-13	-12	-11	-10	-08	-07	-06	-05	-04	-03	-02	-01	-00	31
32	-17	-16	-14	-13	-12	-11	-10	-09	-08	-07	-06	-04	-03	-02	-01	-00	32
33	-17	-16	-15	-14	-13	-12	-10	-09	-08	-07	-06	-05	-03	-02	-01	-00	33
34	-18	-17	-16	-14	-13	-12	-11	-10	-08	-07	-06	-05	-04	-02	-01	-00	34
35	-19	-18	-16	-15	-14	-12	-11	-10	-09	-07	-06	-05	-04	-02	-01	-00	35
36	-20	-18	-17	-15	-14	-13	-12	-10	-09	-08	-06	-05	-04	-03	-01	-00	36
37	-20	-19	-17	-16	-15	-13	-12	-11	-09	-08	-07	-05	-04	-03	-01	-00	37
38	-21	-20	-18	-17	-15	-14	-12	-11	-10	-08	-07	-06	-04	-03	-01	-00	38
39	-22	-20	-19	-17	-16	-14	-13	-11	-10	-09	-07	-06	-04	-03	-01	-00	39
40	-23	-21	-19	-18	-16	-15	-13	-12	-10	-09	-07	-06	-04	-03	-02	-00	40
41	-23	-22	-20	-19	-17	-15	-14	-12	-11	-09	-08	-06	-05	-03	-02	-00	41
42	-24	-22	-21	-19	-18	-16	-14	-13	-11	-10	-08	-06	-05	-03	-02	-00	42
43	-25	-23	-22	-20	-18	-16	-15	-13	-11	-10	-08	-07	-05	-03	-02	-00	43
44	-26	-24	-22	-21	-19	-17	-15	-14	-12	-10	-09	-07	-05	-03	-02	-00	44
45	-27	-25	-23	-21	-19	-18	-16	-14	-12	-11	-09	-07	-05	-04	-02	-00	45
46	-28	-26	-24	-22	-20	-18	-16	-15	-13	-11	-09	-07	-05	-04	-02	-00	46
47	-29	-27	-25	-23	-21	-19	-17	-15	-13	-11	-09	-08	-06	-04	-02	-00	47
48	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-08	-06	-04	-02	-00	48
49	-31	-29	-27	-25	-22	-20	-18	-16	-14	-12	-10	-08	-06	-04	-02	-00	49
50	-32	-30	-28	-25	-23	-21	-19	-17	-15	-13	-10	-08	-06	-04	-02	-00	50
51	-33	-31	-29	-26	-24	-22	-20	-17	-15	-13	-11	-09	-07	-04	-02	-00	51
52	-34	-32	-30	-27	-25	-23	-20	-18	-16	-14	-11	-09	-07	-05	-02	-00	52
53	-36	-33	-31	-28	-26	-23	-21	-19	-16	-14	-12	-09	-07	-05	-02	-00	53
54	-37	-34	-32	-29	-27	-24	-22	-19	-17	-15	-12	-10	-07	-05	-02	-00	54
55	-38	-36	-33	-30	-28	-25	-23	-20	-18	-15	-13	-10	-08	-05	-03	-00	55
56	-40	-37	-34	-32	-29	-26	-24	-21	-18	-16	-13	-10	-08	-05	-03	-00	56
57	-41	-38	-36	-33	-30	-27	-24	-22	-19	-16	-14	-11	-08	-05	-03	-00	57
58	-43	-40	-37	-34	-31	-28	-25	-23	-20	-17	-14	-11	-08	-06	-03	-00	58
59	-45	-42	-38	-35	-32	-29	-26	-23	-20	-18	-15	-12	-09	-06	-03	-00	59
60	-46	-43	-40	-37	-34	-31	-27	-24	-21	-18	-15	-12	-09	-06	-03	-00	60
Lat °	105°	104°	103°	102°	101°	100°	99°	98°	97°	96°	95°	94°	93°	92°	91°	90°	Lat °
	255°	256°	257°	258°	259°	260°	261°	262°	263°	264°	265°	266°	267°	268°	269°	270°	

A - Named opposite to Latitude, except when Hour Angle is between 90° and 270°

HOUR ANGLE

A

TABLE B HOUR ANGLE

Dec °	75°	76°	77°	78°	79°	80°	81°	82°	83°	84°	85°	86°	87°	88°	89°	90°	Dec °
	285°	284°	283°	282°	281°	280°	279°	278°	277°	276°	275°	274°	273°	272°	271°	270°	
0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	0
1	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02	1
2	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04	.04	.03	.03	2
3	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05	3
4	.07	.07	.07	.07	.07	.07	.07	.07	.07	.07	.07	.07	.07	.07	.07	.07	4
5	.09	.09	.09	.09	.09	.09	.09	.09	.09	.09	.09	.09	.09	.09	.09	.09	5
6	.11	.11	.11	.11	.11	.11	.11	.11	.11	.11	.11	.11	.11	.11	.11	.11	6
7	.13	.13	.13	.13	.13	.12	.12	.12	.12	.12	.12	.12	.12	.12	.12	.12	7
8	.15	.15	.14	.14	.14	.14	.14	.14	.14	.14	.14	.14	.14	.14	.14	.14	8
9	.16	.16	.16	.16	.16	.16	.16	.16	.16	.16	.16	.16	.16	.16	.16	.16	9
10	.18	.18	.18	.18	.18	.18	.18	.18	.18	.18	.18	.18	.18	.18	.18	.18	10
11	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.20	.19	.19	.19	11
12	.22	.22	.22	.22	.22	.22	.22	.22	.21	.21	.21	.21	.21	.21	.21	.21	12
13	.24	.24	.24	.24	.24	.23	.23	.23	.23	.23	.23	.23	.23	.23	.23	.23	13
14	.26	.26	.26	.26	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25	14
15	.28	.28	.28	.27	.27	.27	.27	.27	.27	.27	.27	.27	.27	.27	.27	.27	15
16	.30	.30	.29	.29	.29	.29	.29	.29	.29	.29	.29	.29	.29	.29	.29	.29	16
17	.32	.32	.31	.31	.31	.31	.31	.31	.31	.31	.31	.31	.31	.31	.31	.31	17
18	.34	.34	.33	.33	.33	.33	.33	.33	.33	.33	.33	.33	.33	.33	.33	.32	18
19	.36	.36	.35	.35	.35	.35	.35	.35	.35	.35	.35	.35	.35	.35	.34	.34	19
20	.38	.38	.37	.37	.37	.37	.37	.37	.37	.37	.37	.37	.36	.36	.36	.36	20
21	.40	.40	.39	.39	.39	.39	.39	.39	.39	.39	.39	.39	.38	.38	.38	.38	21
22	.42	.42	.42	.41	.41	.41	.41	.41	.41	.41	.41	.41	.41	.40	.40	.40	22
23	.44	.44	.44	.43	.43	.43	.43	.43	.43	.43	.43	.43	.43	.43	.43	.42	23
24	.46	.46	.46	.46	.45	.45	.45	.45	.45	.45	.45	.45	.45	.45	.45	.45	24
25	.48	.48	.48	.48	.48	.47	.47	.47	.47	.47	.47	.47	.47	.47	.47	.47	25
26	.50	.50	.50	.50	.50	.50	.49	.49	.49	.49	.49	.49	.49	.49	.49	.49	26
27	.53	.53	.52	.52	.52	.52	.52	.52	.51	.51	.51	.51	.51	.51	.51	.51	27
28	.55	.55	.55	.54	.54	.54	.54	.54	.54	.54	.53	.53	.53	.53	.53	.53	28
29	.57	.57	.57	.57	.57	.56	.56	.56	.56	.56	.56	.56	.56	.56	.55	.55	29
30	.60	.60	.59	.59	.59	.59	.59	.58	.58	.58	.58	.58	.58	.58	.58	.58	30
31	.62	.62	.62	.61	.61	.61	.61	.61	.61	.60	.60	.60	.60	.60	.60	.60	31
32	.65	.64	.64	.64	.64	.63	.63	.63	.63	.63	.63	.63	.63	.63	.63	.62	32
33	.67	.67	.67	.66	.66	.66	.66	.66	.65	.65	.65	.65	.65	.65	.65	.65	33
34	.70	.70	.69	.69	.69	.68	.68	.68	.68	.68	.68	.68	.68	.68	.68	.67	34
35	.72	.72	.72	.72	.71	.71	.71	.71	.71	.70	.70	.70	.70	.70	.70	.70	35
36	.75	.75	.75	.74	.74	.74	.74	.73	.73	.73	.73	.73	.73	.73	.73	.73	36
37	.78	.78	.77	.77	.77	.77	.76	.76	.76	.76	.75	.75	.75	.75	.75	.75	37
38	.81	.81	.80	.80	.80	.79	.79	.79	.79	.79	.78	.78	.78	.78	.78	.78	38
39	.84	.84	.83	.83	.83	.82	.82	.82	.82	.81	.81	.81	.81	.81	.81	.81	39
40	.87	.87	.86	.86	.86	.85	.85	.85	.85	.84	.84	.84	.84	.84	.84	.84	40
41	.90	.90	.89	.89	.89	.88	.88	.88	.88	.87	.87	.87	.87	.87	.87	.87	41
42	.93	.93	.92	.92	.92	.91	.91	.91	.91	.91	.90	.90	.90	.90	.90	.90	42
43	.97	.96	.96	.95	.95	.95	.94	.94	.94	.94	.94	.94	.93	.93	.93	.93	43
44	1.00	1.00	.99	.99	.99	.98	.98	.98	.97	.97	.97	.97	.97	.97	.97	.97	44
45	1.04	1.03	1.03	1.02	1.02	1.02	1.01	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00	45
46	1.07	1.07	1.06	1.06	1.05	1.05	1.05	1.05	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	46
47	1.11	1.11	1.10	1.10	1.09	1.09	1.09	1.08	1.08	1.08	1.08	1.07	1.07	1.07	1.07	1.07	47
48	1.15	1.14	1.14	1.14	1.13	1.13	1.12	1.12	1.12	1.12	1.11	1.11	1.11	1.11	1.11	1.11	48
49	1.19	1.19	1.18	1.18	1.17	1.17	1.16	1.16	1.16	1.16	1.15	1.15	1.15	1.15	1.15	1.15	49
50	1.23	1.23	1.22	1.22	1.21	1.21	1.21	1.20	1.20	1.20	1.20	1.19	1.19	1.19	1.19	1.19	50
51	1.28	1.27	1.27	1.26	1.26	1.25	1.25	1.25	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.23	51
52	1.33	1.32	1.31	1.31	1.30	1.30	1.30	1.29	1.29	1.29	1.28	1.28	1.28	1.28	1.28	1.28	52
53	1.37	1.37	1.36	1.36	1.35	1.35	1.34	1.34	1.34	1.33	1.33	1.33	1.33	1.33	1.33	1.33	53
54	1.42	1.42	1.41	1.41	1.40	1.40	1.39	1.39	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	54
55	1.48	1.47	1.47	1.46	1.46	1.45	1.45	1.44	1.44	1.44	1.43	1.43	1.43	1.43	1.43	1.43	55
56	1.54	1.53	1.52	1.52	1.51	1.51	1.50	1.50	1.49	1.49	1.49	1.49	1.48	1.48	1.48	1.48	56
57	1.60	1.59	1.58	1.57	1.57	1.57	1.56	1.55	1.55	1.55	1.55	1.54	1.54	1.54	1.54	1.54	57
58	1.66	1.65	1.64	1.64	1.63	1.63	1.62	1.62	1.61	1.61	1.61	1.60	1.60	1.60	1.60	1.60	58
59	1.72	1.72	1.71	1.70	1.70	1.69	1.69	1.68	1.68	1.67	1.67	1.67	1.67	1.67	1.66	1.66	59
60	1.79	1.79	1.78	1.77	1.76	1.76	1.75	1.75	1.75	1.74	1.74	1.74	1.73	1.73	1.73	1.73	60
Dec.	105°	104°	103°	102°	101°	100°	99°	98°	97°	96°	95°	94°	93°	92°	91°	90°	Dec.
	255°	256°	257°	258°	259°	260°	261°	262°	263°	264°	265°	266°	267°	268°	269°	270°	

HOUR ANGLE

B - Always named the same as Declination

B - Always named the same as Declination

B

A - Named opposite to Latitude, except when Hour Angle is between 90° and 270°.

TABLE A HOUR ANGLE																
Lat. °	0° 15'	0° 30'	0° 45'	1° 00'	1° 15'	1° 30'	1° 45'	2° 00'	2° 15'	2° 30'	2° 45'	3° 00'	3° 15'	3° 30'	3° 45'	Lat. °
	359° 45'	359° 30'	359° 15'	359° 00'	358° 45'	358° 30'	358° 15'	358° 00'	357° 45'	357° 30'	357° 15'	357° 00'	356° 45'	356° 30'	356° 15'	
60	397	198	132	99.2	79.4	66.1	56.7	49.6	44.1	39.7	36.1	33.0	30.5	28.3	26.4	60
61	414	207	138	103	82.7	68.9	59.0	51.7	45.9	41.3	37.6	34.4	31.8	29.5	27.5	61
62	431	216	144	108	86.2	71.8	61.6	53.9	47.9	43.1	39.2	35.9	33.1	30.8	28.7	62
63	450	225	150	112	89.9	74.9	64.2	56.2	50.0	45.0	40.9	37.4	34.6	32.1	29.9	63
64	470	235	157	117	94.0	78.3	67.1	58.7	52.2	47.0	42.7	39.1	36.1	33.5	31.3	64
65	491	246	164	123	98.3	81.9	70.2	61.4	54.6	49.1	44.6	40.9	37.8	35.1	32.7	65
66	515	257	172	129	103	85.8	73.5	64.3	57.2	51.4	46.8	42.9	39.6	36.7	34.3	66
67	540	270	180	135	108	90.0	77.1	67.5	60.0	54.0	49.0	45.0	41.5	38.5	35.9	67
68	567	284	189	142	113	94.5	81.0	70.9	63.0	56.7	51.5	47.2	43.6	40.5	37.8	68
69	597	299	199	149	119	99.5	85.3	74.6	66.3	59.7	54.2	49.7	45.9	42.6	39.7	69
70	630	315	210	157	126	105	89.9	78.7	69.9	62.9	57.2	52.4	48.4	44.9	41.9	70
71	666	333	222	166	133	111	95.1	83.2	73.9	66.5	60.5	55.4	51.2	47.5	44.3	71
72	705	353	235	176	141	118	101	88.1	78.3	70.5	64.1	58.7	54.2	50.3	47.0	72
73	750	375	250	187	150	125	107	93.7	83.3	74.9	68.1	62.4	57.6	53.5	49.9	73
74	799	400	266	200	160	133	114	99.9	88.8	79.9	72.6	66.6	61.4	57.0	53.2	74
75	855	428	285	215	171	143	122	107	95.0	85.5	77.7	71.3	65.7	61.0	56.9	75
76	919	460	306	230	184	153	131	115	102	91.3	83.5	76.5	70.6	65.6	61.2	76
77	993	496	331	248	199	165	142	124	110	99.2	90.2	82.7	76.3	70.8	66.1	77
78	1078	539	359	270	216	180	154	135	120	108	97.9	89.7	82.9	76.9	71.8	78
79	1179	590	393	295	236	197	168	147	131	118	107	98.2	90.6	84.1	78.5	79
80	1300	650	433	325	260	217	186	162	144	130	118	108	100	92.7	86.5	80
81	1447	724	482	362	289	241	207	181	161	145	131	121	111	103	96.3	81
82	1631	815	544	408	326	272	233	204	181	163	148	136	125	116	109	82
83	1867	933	622	467	373	311	267	233	207	187	170	155	143	133	124	83
Lat.	179° 45'	179° 30'	179° 15'	179° 00'	178° 45'	178° 30'	178° 15'	178° 00'	177° 45'	177° 30'	177° 15'	177° 00'	176° 45'	176° 30'	176° 15'	Lat.
	180° 15'	180° 30'	180° 45'	181° 00'	181° 15'	181° 30'	181° 45'	182° 00'	182° 15'	182° 30'	182° 45'	183° 00'	183° 15'	183° 30'	183° 45'	

HOUR ANGLE

TABLE A HOUR ANGLE																
Lat. °	4° 00'	4° 15'	4° 30'	4° 45'	5° 00'	5° 15'	5° 30'	5° 45'	6° 00'	6° 15'	6° 30'	6° 45'	7° 00'	7° 15'	7° 30'	Lat. °
	356° 00'	355° 45'	355° 30'	355° 15'	355° 00'	354° 45'	354° 30'	354° 15'	354° 00'	353° 45'	353° 30'	353° 15'	353° 00'	352° 45'	352° 30'	
60	24.8	23.3	22.0	20.8	19.8	18.8	18.0	17.2	16.5	15.8	15.2	14.6	14.1	13.6	13.2	60
61	25.8	24.3	22.9	21.7	20.6	19.6	18.7	17.9	17.2	16.5	15.8	15.2	14.7	14.2	13.7	61
62	26.9	25.3	23.9	22.6	21.5	20.5	19.5	18.7	17.9	17.2	16.5	15.9	15.3	14.8	14.3	62
63	28.1	26.4	24.9	23.6	22.4	21.4	20.4	19.5	18.7	17.9	17.2	16.6	16.0	15.4	14.9	63
64	29.3	27.6	26.1	24.7	23.4	22.3	21.3	20.4	19.5	18.7	18.0	17.3	16.7	16.1	15.6	64
65	30.7	28.9	27.2	25.8	24.5	23.3	22.3	21.3	20.4	19.6	18.8	18.1	17.5	16.9	16.3	65
66	32.1	30.2	28.5	27.0	25.7	24.4	23.3	22.3	21.4	20.5	19.7	19.0	18.3	17.7	17.1	66
67	33.7	31.7	29.9	28.4	26.9	25.6	24.5	23.4	22.4	21.5	20.7	19.9	19.2	18.5	17.9	67
68	35.4	33.3	31.4	29.8	28.3	26.9	25.7	24.6	23.5	22.6	21.7	20.9	20.2	19.5	18.8	68
69	37.3	35.1	33.1	31.4	29.8	28.4	27.1	25.9	24.8	23.8	22.9	22.0	21.2	20.5	19.8	69
70	39.3	37.0	34.9	33.1	31.4	29.9	28.5	27.3	26.1	25.1	24.1	23.2	22.4	21.6	20.9	70
71	41.5	39.1	36.9	35.0	33.2	31.6	30.2	28.9	27.6	26.5	25.5	24.5	23.7	22.8	22.1	71
72	44.0	41.4	39.1	37.0	35.2	33.5	32.0	30.6	29.3	28.1	27.0	26.0	25.1	24.2	23.4	72
73	46.8	44.0	41.6	39.4	37.4	35.6	34.0	32.5	31.1	30.0	28.7	27.6	26.6	25.7	24.8	73
74	50.0	46.9	44.3	42.0	39.9	38.0	36.2	34.6	33.2	31.9	30.6	29.5	28.4	27.4	26.5	74
75	53.4	50.2	47.4	44.9	42.7	40.6	38.8	37.1	35.5	34.1	32.8	31.5	30.4	29.3	28.4	75
76	57.4	54.0	51.0	48.3	45.8	43.7	41.7	39.8	38.2	36.6	35.2	33.9	32.7	31.5	30.5	76
77	62.0	58.3	55.0	52.1	49.5	47.1	45.0	43.0	41.2	39.6	38.0	36.6	35.2	34.1	32.9	77
78	67.3	63.3	59.8	56.6	53.8	51.2	48.9	46.7	44.8	43.0	41.3	39.8	38.3	37.0	35.7	78
79	73.6	69.2	65.4	61.9	58.8	56.0	53.4	51.1	49.0	47.0	45.2	43.5	41.9	40.0	39.1	79
80	81.1	76.3	72.1	68.3	64.8	61.7	58.9	56.3	54.0	51.8	49.8	47.9	46.2	44.6	43.1	80
81	90.3	85.0	80.2	76.0	72.2	68.7	65.6	62.7	60.1	57.7	55.4	53.3	51.4	49.6	48.0	81
82	102	96.0	90.4	85.6	81.3	77.4	73.9	70.7	67.7	65.0	62.5	60.1	58.0	55.9	54.0	82
83	117	110	104	98.0	93.1	88.6	84.6	80.9	77.5	74.4	71.5	68.8	66.3	64.0	61.9	83
Lat.	176° 00'	175° 45'	175° 30'	175° 15'	175° 00'	174° 45'	174° 30'	174° 15'	173° 45'	173° 30'	173° 15'	173° 00'	172° 45'	172° 30'	172° 15'	Lat.
	184° 00'	184° 15'	184° 30'	184° 45'	185° 00'	185° 15'	185° 30'	185° 45'	186° 00'	186° 15'	186° 30'	186° 45'	187° 00'	187° 15'	187° 30'	

HOUR ANGLE

A - Named opposite to Latitude, except when Hour Angle is between 90° and 270°.

TABLE B HOUR ANGLE

Dec. °	0° 15'	0° 30'	0° 45'	1° 00'	1° 15'	1° 30'	1° 45'	2° 00'	2° 15'	2° 30'	2° 45'	3° 00'	3° 15'	3° 30'	3° 45'	Dec. °
60	359° 45'	359° 30'	359° 15'	359° 00'	358° 45'	358° 30'	358° 15'	358° 00'	357° 45'	357° 30'	357° 15'	357° 00'	356° 45'	356° 30'	356° 15'	60
61	414	207	138	103	82.7	68.9	59.1	51.7	46.0	41.4	37.6	34.5	31.8	29.6	27.6	61
62	431	216	144	108	86.2	71.8	61.6	53.9	47.9	43.1	39.2	35.9	33.2	30.8	28.8	62
63	450	225	150	112	90.0	75.0	64.3	56.2	50.0	45.0	40.9	37.5	34.6	32.1	30.0	63
64	470	235	157	117	94.0	78.3	67.1	58.7	52.2	47.0	42.7	39.2	36.2	33.6	31.4	64
65	491	246	164	123	98.3	81.9	70.2	61.4	54.6	49.2	44.7	41.0	37.8	35.1	32.8	65
66	515	257	172	129	103	85.8	73.5	64.4	57.2	51.5	46.8	42.9	39.6	36.8	34.3	66
67	540	270	180	135	108	90.0	77.1	67.5	60.0	54.0	49.1	45.0	41.6	38.6	36.0	67
68	567	284	189	142	113	94.6	81.0	70.9	63.0	56.7	51.6	47.3	43.7	40.5	37.8	68
69	597	299	199	149	119	99.5	85.3	74.6	66.4	59.7	54.3	49.8	46.0	42.7	39.8	69
70	630	315	210	157	126	105	90.0	78.7	70.0	63.0	57.3	52.5	48.5	45.0	42.0	70
71	666	333	222	166	133	111	95.1	83.2	74.0	66.6	60.5	55.5	51.2	47.6	44.4	71
72	705	353	235	176	141	118	101	88.2	78.4	70.6	64.2	58.8	54.3	50.4	47.1	72
73	750	375	250	187	150	125	107	93.7	83.3	75.0	68.2	62.5	57.7	53.6	50.0	73
74	799	400	266	200	160	133	114	100	88.8	80.0	72.7	66.6	61.5	57.1	53.3	74
75	855	428	285	214	171	143	122	107	95.1	85.6	77.8	71.3	65.8	61.1	57.1	75
Dec.	179° 45'	179° 30'	179° 15'	179° 00'	178° 45'	178° 30'	178° 15'	178° 00'	177° 45'	177° 30'	177° 15'	177° 00'	176° 45'	176° 30'	176° 15'	Dec.
	180° 15'	180° 30'	180° 45'	181° 00'	181° 15'	181° 30'	181° 45'	182° 00'	182° 15'	182° 30'	182° 45'	183° 00'	183° 15'	183° 30'	183° 45'	

HOUR ANGLE

TABLE B - HOUR ANGLE

Dec. °	3° 45'	4° 00'	4° 15'	4° 30'	4° 45'	5° 00'	5° 15'	5° 30'	5° 45'	6° 00'	6° 15'	6° 30'	6° 45'	7° 00'	7° 15'	7° 30'	Dec. °
60	356° 15'	356° 00'	355° 45'	355° 30'	355° 15'	355° 00'	354° 45'	354° 30'	354° 15'	353° 45'	353° 30'	353° 15'	353° 00'	352° 45'	352° 30'	352° 15'	60
61	26.5	24.8	23.4	22.1	20.9	19.9	18.9	18.1	17.3	16.6	15.9	15.3	14.7	14.2	13.7	13.3	61
62	27.6	25.9	24.3	23.0	21.8	20.7	19.7	18.8	18.0	17.3	16.6	15.9	15.3	14.8	14.3	13.8	62
63	28.8	27.0	25.4	24.0	22.7	21.6	20.6	19.6	18.8	18.0	17.3	16.6	16.0	15.4	14.9	14.4	63
64	30.0	28.1	26.5	25.0	23.7	22.5	21.4	20.5	19.6	18.8	18.0	17.3	16.7	16.1	15.6	15.0	64
65	31.3	29.4	27.7	26.1	24.8	23.5	22.4	21.4	20.5	19.6	18.8	18.1	17.4	16.8	16.2	15.7	65
66	32.8	30.7	28.9	27.3	25.9	24.6	23.4	22.4	21.4	20.5	19.7	18.9	18.2	17.6	17.0	16.4	66
67	34.3	32.2	30.3	28.6	27.1	25.8	24.5	23.4	22.4	21.5	20.6	19.8	19.1	18.4	17.8	17.2	67
68	36.0	33.8	31.8	30.0	28.4	27.0	25.7	24.6	23.5	22.5	21.6	20.8	20.1	19.3	18.7	18.0	68
69	37.8	35.5	33.4	31.5	29.9	28.4	27.0	25.8	24.7	23.7	22.7	21.9	21.1	20.3	19.6	19.0	69
70	39.8	37.3	35.2	33.2	31.5	29.9	28.5	27.2	26.0	24.9	23.9	23.0	22.2	21.4	20.6	20.0	70
71	42.0	39.4	37.1	35.0	33.2	31.5	30.0	28.7	27.4	26.3	25.2	24.3	23.4	22.5	21.8	21.1	71
72	44.4	41.6	39.2	37.0	35.1	33.3	31.7	30.3	29.0	27.8	26.7	25.7	24.7	23.8	23.0	22.6	72
73	47.1	44.1	41.5	39.2	37.2	35.3	33.6	32.1	30.7	29.4	28.3	27.2	26.2	25.3	24.4	23.3	73
74	50.0	46.9	44.1	41.7	39.5	37.5	35.8	34.1	32.7	31.3	30.0	28.9	27.8	26.8	25.9	25.1	74
75	53.3	50.0	47.1	44.5	42.1	40.0	38.1	36.4	34.8	33.4	32.0	30.8	29.7	28.6	27.6	26.7	75
75	57.1	53.5	50.4	47.6	45.1	42.8	40.8	38.9	37.3	35.7	34.3	33.0	31.8	30.6	29.6	28.6	75
Dec.	176° 15'	176° 00'	175° 45'	175° 30'	175° 15'	175° 00'	174° 45'	174° 30'	174° 15'	174° 00'	173° 45'	173° 30'	173° 15'	173° 00'	172° 45'	172° 30'	Dec.
	183° 45'	184° 00'	184° 15'	184° 30'	184° 45'	185° 00'	185° 15'	185° 30'	185° 45'	186° 00'	186° 15'	186° 30'	186° 45'	187° 00'	187° 15'	187° 30'	

HOUR ANGLE

B - Always named the same as Declination

B - Always named the same as Declination

A - Named opposite to Latitude, except when Hour Angle is between 90° and 270°

TABLE A - HOUR ANGLE																									
Lat. °	7°		7°		8°		8°		8°		9°		9°		9°		10°		10°		10°		11°		Lat. °
	30'	45'	00'	15'	30'	45'	00'	15'	30'	45'	00'	15'	30'	45'	00'	15'	30'	45'	00'	15'	30'	45'	00'	15'	
	352°	352°	352°	351°	351°	351°	350°	350°	350°	350°	350°	350°	349°	349°	349°	349°	349°	349°	349°	349°	349°	348°	348°		
	30'	15'	00'	45'	30'	15'	00'	45'	30'	15'	00'	45'	30'	15'	00'	45'	30'	15'	00'	45'	30'	15'	00'	45'	
60	13.2	12.7	12.3	11.9	11.6	11.3	10.9	10.6	10.4	10.1	9.82	9.58	9.35	9.12	8.91	8.71	8.51	8.31	8.11	7.91	7.71	7.51	7.31	7.11	60
61	13.7	13.3	12.8	12.4	12.1	11.7	11.4	11.1	10.8	10.5	10.2	9.98	9.73	9.50	9.28	9.07	8.86	8.65	8.44	8.23	8.02	7.81	7.61	7.41	61
62	14.3	13.8	13.4	13.0	12.6	12.2	11.9	11.5	11.2	10.9	10.7	10.4	10.1	9.91	9.68	9.46	9.24	9.02	8.80	8.58	8.36	8.14	7.92	7.70	62
63	14.9	14.4	14.0	13.5	13.1	12.8	12.4	12.1	11.7	11.4	11.1	10.9	10.6	10.3	10.1	9.87	9.64	9.41	9.18	8.95	8.72	8.49	8.26	8.03	63
64	15.6	15.1	14.6	14.1	13.7	13.3	12.9	12.6	12.3	11.9	11.6	11.3	11.1	10.8	10.5	10.3	10.0	9.76	9.52	9.28	9.04	8.80	8.56	8.32	64
65	16.3	15.8	15.3	14.8	14.3	13.9	13.5	13.2	12.8	12.5	12.2	11.9	11.6	11.3	11.0	10.8	10.5	10.2	9.98	9.74	9.50	9.26	9.02	8.78	65
66	17.1	16.5	16.0	15.5	15.0	14.6	14.2	13.8	13.4	13.1	12.7	12.4	12.1	11.8	11.6	11.3	11.0	10.7	10.4	10.1	9.87	9.63	9.39	9.15	66
67	17.9	17.3	16.8	16.2	15.8	15.3	14.9	14.5	14.1	13.7	13.4	13.0	12.7	12.4	12.1	11.8	11.5	11.2	10.9	10.6	10.3	10.0	9.76	9.52	67
68	18.8	18.2	17.6	17.1	16.6	16.1	15.6	15.2	14.8	14.4	14.0	13.7	13.4	13.0	12.7	12.4	12.1	11.8	11.5	11.2	10.9	10.6	10.3	10.0	68
69	19.8	19.1	18.5	18.0	17.4	16.9	16.5	16.0	15.6	15.2	14.8	14.4	14.1	13.7	13.4	13.1	12.8	12.5	12.2	11.9	11.6	11.3	11.0	10.7	69
70	20.9	20.2	19.6	19.0	18.4	17.9	17.4	16.9	16.4	16.0	15.6	15.2	14.8	14.5	14.1	13.8	13.5	13.2	12.9	12.6	12.3	12.0	11.7	11.4	70
71	22.1	21.3	20.7	20.0	19.4	18.9	18.3	17.8	17.4	16.9	16.5	16.1	15.7	15.3	14.9	14.6	14.3	14.0	13.7	13.4	13.1	12.8	12.5	12.2	71
72	23.4	22.6	21.9	21.2	20.6	20.0	19.4	18.9	18.4	17.9	17.5	17.0	16.6	16.2	15.8	15.5	15.2	14.9	14.6	14.3	14.0	13.7	13.4	13.1	72
73	24.8	24.0	23.3	22.6	21.9	21.3	20.6	20.1	19.5	19.0	18.6	18.1	17.7	17.2	16.8	16.4	16.1	15.8	15.5	15.2	14.9	14.6	14.3	14.0	73
74	26.5	25.6	24.8	24.1	23.3	22.7	22.0	21.4	20.8	20.3	19.8	19.3	18.8	18.4	17.9	17.5	17.1	16.7	16.4	16.1	15.8	15.5	15.2	14.9	74
75	28.4	27.4	26.6	25.7	25.0	24.3	23.6	22.9	22.3	21.7	21.2	20.6	20.1	19.7	19.2	18.8	18.4	18.0	17.6	17.2	16.8	16.4	16.0	15.6	75
76	30.5	29.5	28.5	27.7	26.8	26.1	25.3	24.6	24.0	23.3	22.8	22.2	21.6	21.1	20.6	20.2	19.8	19.4	19.0	18.6	18.2	17.8	17.4	17.0	76
77	32.9	31.8	30.8	29.9	29.0	28.1	27.4	26.6	25.9	25.2	24.6	24.0	23.4	22.8	22.3	21.8	21.4	21.0	20.6	20.2	19.8	19.4	19.0	18.6	77
78	35.7	34.6	33.5	32.5	31.5	30.6	29.7	28.9	28.1	27.4	26.7	26.0	25.4	24.8	24.3	23.8	23.4	23.0	22.6	22.2	21.8	21.4	21.0	20.6	78
79	39.1	37.8	36.6	35.5	34.4	33.4	32.5	31.6	30.7	29.9	29.2	28.5	27.8	27.1	26.5	25.9	25.4	25.0	24.6	24.2	23.8	23.4	23.0	22.6	79
80	43.1	41.7	40.4	39.1	38.0	36.9	35.8	34.8	33.9	33.0	32.2	31.4	30.6	29.9	29.2	28.5	27.9	27.4	27.0	26.6	26.2	25.8	25.4	25.0	80
81	48.0	46.4	44.9	43.6	42.2	41.0	39.9	38.8	37.7	36.7	35.8	34.9	34.1	33.3	32.5	31.7	31.0	30.4	29.9	29.5	29.1	28.7	28.3	27.9	81
82	54.0	52.3	50.6	49.1	47.6	46.2	44.9	43.7	42.5	41.4	40.4	39.4	38.4	37.5	36.6	35.8	35.0	34.3	33.7	33.3	32.9	32.5	32.1	31.7	82
83	61.9	59.9	58.0	56.2	54.5	52.9	51.4	50.0	48.7	47.4	46.2	45.0	43.9	42.9	41.9	41.0	40.1	39.3	38.6	38.1	37.6	37.1	36.6	36.1	83
Lat	172°		172°		172°		171°		171°		170°		170°		170°		169°		169°		169°		168°		Lat
	30'	15'	00'	45'	30'	15'	00'	45'	30'	15'	00'	45'	30'	15'	00'	45'	30'	15'	00'	45'	30'	15'	00'	45'	
	187°	187°	188°	188°	188°	188°	189°	189°	189°	189°	190°	190°	190°	190°	190°	190°	190°	190°	190°	190°	191°	191°	191°	191°	
	30'	45'	00'	15'	30'	45'	00'	15'	30'	45'	00'	15'	30'	45'	00'	15'	30'	45'	00'	15'	30'	45'	00'	15'	

HOUR ANGLE

TABLE A - HOUR ANGLE																									
Lat °	11°		11°		12°		12°		12°		13°		13°		13°		14°		14°		14°		15°		Lat °
	15'	30'	45'	00'	15'	30'	45'	00'	15'	30'	45'	00'	15'	30'	45'	00'	15'	30'	45'	00'	15'	30'	45'	00'	
	348°	348°	348°	348°	347°	347°	347°	347°	346°	346°	346°	346°	345°	345°	345°	345°	345°	345°	345°	345°	345°	345°	345°		
	45'	30'	15'	00'	45'	30'	15'	00'	45'	30'	15'	00'	45'	30'	15'	00'	45'	30'	15'	00'	45'	30'	15'	00'	
60	8.71	8.51	8.33	8.15	7.98	7.81	7.65	7.50	7.36	7.21	7.08	6.95	6.82	6.70	6.58	6.46									60
61	9.07	8.87	8.67	8.49	8.31	8.14	7.97	7.81	7.66	7.51	7.37	7.24	7.10	6.98	6.85	6.73									61
62	9.46	9.24	9.04	8.85	8.66	8.48	8.31	8.15	7.99	7.83	7.69	7.54	7.41	7.27	7.14	7.02									62
63	9.87	9.65	9.44	9.23	9.04	8.85	8.67	8.50	8.33	8.17	8.02	7.87	7.73	7.59	7.45	7.32									63
64	10.3	10.1	9.86	9.65	9.44	9.25	9.06	8.88	8.71	8.54	8.38	8.22	8.07	7.93	7.79	7.65									64
65	10.8	10.5	10.3	10.1	9.88	9.67	9.48	9.29	9.11	8.93	8.76	8.60	8.44	8.29	8.15	8.00									65
66	11.3	11.0	10.8	10.6	10.3	10.1	9.93	9.73	9.54	9.36	9.18	9.01	8.84	8.68	8.53	8.38									66
67	11.8	11.6	11.3	11.1	10.9	10.6	10.4	10.2	10.0	9.81	9.63	9.45	9.28	9.11	8.95	8.79									67
68	12.4	12.2	11.9	11.6	11.4	11.2	10.9	10.7	10.5	10.3	10.1	9.93	9.75	9.57	9.40	9.24									68
69	13.1	12.8	12.5	12.3	12.0	11.8	11.5	11.3	11.1	10.9	10.7	10.5	10.3	10.1	9.90	9.72									69
70	13.8	13.5	13.2	12.9	12.7	12.4	12.1	11.9	11.7	11.4	11.2	11.0	10.8	10.6	10.4	10.3									70
71	14.6	14.3	14.0	13.7	13.4	13.1	12.8	12.6	12.3	12.1	11.9	11.7	11.4	11.2	11.0	10.8									71
72	15.5	15.1	14.8	14.5	14.2	13.9	13.6	13.3	13.1	12.8	12.6	12.3	12.1	11.9	11.7	11.5									72
73	16.4	16.1	15.7	15.4	15.1	14.8	14.5	14.2	13.9	13.6	13.4	13.1	12.9	12.7	12.4	12.2									73
74	17.5	17.1	16.8	16.4	16.1	15.7	15.4	15.1	14.8	14.5	14.3	14.0	13.7	13.5	13.3	13.0									74
75	18.8	18.3	17.9	17.6	17.2	16.8	16.5	16.2	15.9	15.6	15.3	15.0	14.7	14.4	14.2	13.9									75
76	20.2	19.7	19.3	18.9	18.5	18.1	17.7	17.4	17.0	16.7	16.4	16.1	15.8	15.5	15.2	15.0									76
77	21.8	21.3	20.8	20.4	20.0	19.5	19.2	18.8	18.4	18.0	17.7	17.4	17.1	16.8	16.5	16.2									77
78	23.7	23.1	22.6	22.1	21.7	21.2	20.8	20.4	20.0	19.6	19.2	18.9	18.5	18.2	17.9	17.6									78
79	25.9	25.3	24.7	24.2	23.7	23.2	22.7	22.3	21.9	21.4	21.0	20.6	20.3	19.9	19.5	19.2									79
80	28.5	27.9	27.3	26.7	26.1	25.6	25.1	24.5	24.1	23.6	23.2	22.8	22.3	21.9	21.5	21.2									80
81	31.7	31.0	30.4	29.7	29.1	28.5	27.9	27.4	26.8	26.3	25.8	25.3	24.9	24.4	24.0	23.6									81
82	35.8	35.0	34.2	33.5	32.8	32.1	31.5	30.8	30.2	29.6	29.1	28.5	28.0	27.5	27.0	26.6									82
83	41.0	40.0	39.2	38.3	37.5	36.7	36.0	35.3	34.6	33.9	33.3	32.7	32.1	31.5	30.9	30.4									83
Lat	168°		168°		167°		167°		166°		166°		166°		166°		165°		165°		165°		165°		Lat
	45'	30'	15'	00'	45'	30'	15'	00'	45'	30'	15'	00'	45'	30'	15'	00'	45'	30'	15'	00'	45'	30'	15'	00'	
	191°	191°	191°	192°	192°	192°	192°	192°	193°	193°	193°	193°	193°	194°	194°	194°	194°	194°	194°	194°	194°	195°	195°	195°	
	15'	30'	45'	00'	15'	30'	45'	00'	15'	30'	45'	00'	15'	30'	45'	00'	15'	30'	45'	00'	15'	30'	45'	00'	
HOUR ANGLE																									

TABLE B HOUR ANGLE

Dec °	7° 30'	7° 45'	8° 00'	8° 15'	8° 30'	8° 45'	9° 00'	9° 15'	9° 30'	9° 45'	10° 00'	10° 15'	10° 30'	10° 45'	11° 00'	11° 15'	Dec °
60	352° 30'	352° 15'	352° 00'	351° 45'	351° 30'	351° 15'	351° 00'	350° 45'	350° 30'	350° 15'	350° 00'	349° 45'	349° 30'	349° 15'	349° 00'	348° 45'	60
61	13-3	12-8	12-4	12-1	11-7	11-4	11-1	10-8	10-5	10-2	9-97	9-73	9-50	9-29	9-08	8-88	61
62	13-8	13-4	13-0	12-6	12-2	11-9	11-5	11-2	10-9	10-7	10-4	10-1	9-90	9-67	9-45	9-25	62
63	14-4	13-9	13-5	13-1	12-7	12-4	12-0	11-7	11-4	11-1	10-8	10-6	10-3	10-1	9-86	9-64	63
64	15-0	14-6	14-1	13-7	13-3	12-9	12-5	12-2	11-9	11-6	11-3	11-0	10-8	10-5	10-3	10-1	64
65	15-7	15-2	14-7	14-3	13-9	13-5	13-1	12-8	12-4	12-1	11-8	11-5	11-3	11-0	10-7	10-5	65
66	16-4	15-9	15-4	14-9	14-5	14-1	13-7	13-3	13-0	12-7	12-3	12-1	11-8	11-5	11-2	11-0	66
67	17-2	16-7	16-1	15-7	15-2	14-8	14-4	14-0	13-6	13-3	12-9	12-6	12-3	12-0	11-8	11-5	67
68	18-0	17-5	16-9	16-4	15-9	15-5	15-1	14-7	14-3	13-9	13-6	13-2	12-9	12-6	12-3	12-1	68
69	19-0	18-4	17-8	17-2	16-7	16-3	15-8	15-4	15-0	14-6	14-3	13-9	13-6	13-3	13-0	12-7	69
70	20-0	19-3	18-7	18-2	17-6	17-1	16-7	16-2	15-8	15-4	15-0	14-6	14-3	14-0	13-7	13-4	70
71	21-1	20-4	19-7	19-1	18-6	18-1	17-6	17-1	16-6	16-2	15-8	15-4	15-1	14-7	14-4	14-1	71
72	22-3	21-5	20-9	20-2	19-6	19-1	18-6	18-1	17-6	17-1	16-7	16-3	15-9	15-6	15-2	14-9	72
73	23-6	22-8	22-1	21-4	20-8	20-2	19-7	19-1	18-6	18-2	17-7	17-3	16-9	16-5	16-1	15-8	73
74	25-1	24-3	23-5	22-8	22-1	21-5	20-9	20-3	19-8	19-3	18-8	18-4	18-0	17-5	17-1	16-8	74
75	26-7	25-9	25-1	24-3	23-6	22-9	22-3	21-7	21-1	20-6	20-1	19-6	19-1	18-7	18-3	17-9	75
75	28-6	27-7	26-8	26-0	25-3	24-5	23-9	23-2	22-6	22-0	21-5	21-0	20-5	20-0	19-6	19-1	75

Dec	172° 30'	172° 15'	172° 00'	171° 45'	171° 30'	171° 15'	171° 00'	170° 45'	170° 30'	170° 15'	170° 00'	169° 45'	169° 30'	169° 15'	169° 00'	168° 45'	Dec.
	187° 30'	187° 45'	188° 00'	188° 15'	188° 30'	188° 45'	189° 00'	189° 15'	189° 30'	189° 45'	190° 00'	190° 15'	190° 30'	190° 45'	191° 00'	191° 15'	

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HOUR ANGLE

TABLE B - HOUR ANGLE

Dec °	11° 15'	11° 30'	11° 45'	12° 00'	12° 15'	12° 30'	12° 45'	13° 00'	13° 15'	13° 30'	13° 45'	14° 00'	14° 15'	14° 30'	14° 45'	15° 00'	Dec °
60	348° 45'	348° 30'	348° 15'	348° 00'	347° 45'	347° 30'	347° 15'	347° 00'	346° 45'	346° 30'	346° 15'	346° 00'	345° 45'	345° 30'	345° 15'	345° 00'	60
61	8-88	8-69	8-51	8-33	8-16	8-00	7-85	7-70	7-56	7-42	7-29	7-16	7-04	6-92	6-80	6-69	61
62	9-25	9-05	8-86	8-68	8-50	8-34	8-17	8-02	7-87	7-73	7-59	7-46	7-33	7-21	7-09	6-97	62
63	9-64	9-43	9-24	9-05	8-86	8-69	8-52	8-36	8-21	8-06	7-91	7-77	7-64	7-51	7-39	7-27	63
64	10-1	9-84	9-64	9-44	9-25	9-07	8-89	8-72	8-56	8-41	8-26	8-11	7-97	7-84	7-71	7-58	64
65	10-5	10-3	10-1	9-86	9-66	9-47	9-29	9-11	8-95	8-78	8-63	8-48	8-33	8-19	8-05	7-92	65
66	11-0	10-8	10-5	10-3	10-1	9-91	9-72	9-53	9-36	9-19	9-02	8-86	8-71	8-57	8-42	8-29	66
67	11-5	11-3	11-0	10-8	10-6	10-4	10-2	9-98	9-80	9-62	9-45	9-28	9-12	8-97	8-82	8-68	67
68	12-1	11-8	11-6	11-3	11-1	10-9	10-7	10-5	10-3	10-1	9-91	9-74	9-57	9-41	9-25	9-10	68
69	12-7	12-4	12-2	11-9	11-7	11-4	11-2	11-0	10-8	10-6	10-4	10-2	10-1	9-89	9-72	9-56	69
70	13-4	13-1	12-8	12-5	12-3	12-0	11-8	11-6	11-4	11-2	11-0	10-8	10-6	10-4	10-2	10-1	70
71	14-1	13-8	13-5	13-2	12-9	12-7	12-4	12-2	12-0	11-8	11-6	11-4	11-2	11-0	10-8	10-6	71
72	14-9	14-6	14-3	14-0	13-7	13-4	13-2	12-9	12-7	12-4	12-2	12-0	11-8	11-6	11-4	11-2	72
73	15-8	15-4	15-1	14-8	14-5	14-2	13-9	13-7	13-4	13-2	12-9	12-7	12-5	12-3	12-1	11-9	73
74	16-8	16-4	16-1	15-7	15-4	15-1	14-8	14-5	14-3	14-0	13-8	13-5	13-3	13-1	12-8	12-6	74
75	17-9	17-5	17-1	16-8	16-4	16-1	15-8	15-5	15-2	14-9	14-7	14-4	14-2	13-9	13-7	13-5	75
75	19-1	18-7	18-3	18-0	17-6	17-2	16-9	16-6	16-3	16-0	15-7	15-4	15-2	14-9	14-7	14-4	75
	168° 45'	168° 30'	168° 15'	168° 00'	167° 45'	167° 30'	167° 15'	167° 00'	166° 45'	166° 30'	166° 15'	166° 00'	165° 45'	165° 30'	165° 15'	165° 00'	
	191° 15'	191° 30'	191° 45'	192° 00'	192° 15'	192° 30'	192° 45'	193° 00'	193° 15'	193° 30'	193° 45'	194° 00'	194° 15'	194° 30'	194° 45'	195° 00'	

Always named the same as Declination

HOUR ANGLE

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TABLE A HOUR ANGLE

Lat °	15° 00'	15° 30'	16° 00'	16° 30'	17° 00'	17° 30'	18° 00'	18° 30'	19° 00'	19° 30'	20° 00'	20° 30'	21° 00'	21° 30'	22° 00'	22° 30'	Lat °
60	345° 00'	344° 30'	344° 00'	343° 30'	343° 00'	342° 30'	342° 00'	341° 30'	341° 00'	340° 30'	340° 00'	339° 30'	339° 00'	338° 30'	338° 00'	337° 30'	60
61	6:46	6:25	6:04	5:85	5:67	5:49	5:33	5:18	5:03	4:89	4:76	4:63	4:51	4:40	4:29	4:18	61
62	6:73	6:51	6:29	6:09	5:90	5:72	5:55	5:39	5:24	5:09	4:96	4:83	4:70	4:58	4:47	4:36	62
63	7:02	6:78	6:56	6:35	6:15	5:96	5:79	5:62	5:46	5:31	5:17	5:03	4:90	4:77	4:65	4:54	63
64	7:32	7:08	6:84	6:63	6:42	6:23	6:04	5:87	5:70	5:54	5:39	5:25	5:11	4:98	4:86	4:74	64
65	7:65	7:39	7:15	6:92	6:71	6:50	6:31	6:13	5:95	5:79	5:63	5:48	5:34	5:21	5:08	4:95	65
66	8:00	7:73	7:48	7:24	7:01	6:80	6:60	6:41	6:23	6:06	5:89	5:74	5:59	5:44	5:31	5:18	66
67	8:38	8:10	7:83	7:58	7:35	7:12	6:91	6:71	6:52	6:34	6:17	6:01	5:85	5:70	5:56	5:42	67
68	8:79	8:50	8:22	7:95	7:71	7:47	7:25	7:04	6:84	6:65	6:47	6:30	6:14	5:98	5:83	5:69	68
69	9:24	8:92	8:63	8:36	8:10	7:85	7:62	7:40	7:19	6:99	6:80	6:62	6:45	6:28	6:13	5:98	69
70	9:72	9:39	9:09	8:80	8:52	8:26	8:02	7:79	7:57	7:36	7:16	6:97	6:79	6:61	6:45	6:29	70
71	10:3	9:91	9:58	9:28	8:99	8:71	8:46	8:21	7:98	7:76	7:55	7:35	7:16	6:98	6:80	6:63	71
72	10:8	10:5	10:1	9:81	9:50	9:21	8:94	8:68	8:43	8:20	7:98	7:77	7:57	7:37	7:19	7:01	72
73	11:5	11:1	10:7	10:4	10:1	9:76	9:47	9:20	8:94	8:69	8:46	8:23	8:02	7:81	7:62	7:43	73
74	12:2	11:8	11:4	11:1	10:7	10:4	10:1	9:78	9:50	9:24	8:99	8:75	8:52	8:30	8:10	7:90	74
75	13:0	12:6	12:2	11:8	11:4	11:1	10:7	10:4	10:1	9:85	9:58	9:33	9:09	8:85	8:63	8:42	75
76	13:9	13:5	13:0	12:6	12:2	11:8	11:5	11:2	10:8	10:5	10:3	9:98	9:72	9:47	9:24	9:01	76
77	15:0	14:5	14:0	13:5	13:1	12:7	12:4	12:0	11:7	11:3	11:1	10:7	10:5	10:2	9:93	9:68	77
78	16:2	15:6	15:1	14:6	14:2	13:7	13:3	13:0	12:6	12:2	11:9	11:6	11:3	11:0	10:7	10:5	78
79	17:6	17:0	16:4	15:9	15:4	14:9	14:5	14:1	13:7	13:3	12:9	12:6	12:3	11:9	11:7	11:4	79
80	19:2	18:6	17:9	17:4	16:8	16:3	15:8	15:4	14:9	14:5	14:1	13:8	13:4	13:1	12:7	12:4	80
81	21:2	20:5	19:8	19:2	18:6	18:0	17:5	17:0	16:5	16:0	15:6	15:2	14:8	14:4	14:0	13:7	81
82	23:6	22:8	22:0	21:3	20:7	20:0	19:4	18:9	18:3	17:8	17:4	16:9	16:5	16:0	15:6	15:2	82
83	26:6	25:7	24:8	24:0	23:3	22:6	21:9	21:3	20:7	20:1	19:6	19:0	18:5	18:1	17:6	17:2	83
83	30:4	29:4	28:4	27:5	26:6	25:8	25:1	24:3	23:7	23:0	22:4	21:8	21:2	20:7	20:2	19:7	83

HOUR ANGLE

TABLE A - HOUR ANGLE

Lat °	22° 30'	23° 00'	23° 30'	24° 00'	24° 30'	25° 00'	25° 30'	26° 00'	26° 30'	27° 00'	27° 30'	28° 00'	28° 30'	29° 00'	29° 30'	30° 00'	Lat °
60	337° 30'	337° 00'	336° 30'	336° 00'	335° 30'	335° 00'	334° 30'	334° 00'	333° 30'	333° 00'	332° 30'	332° 00'	331° 30'	331° 00'	330° 30'	330° 00'	60
61	4:18	4:08	3:98	3:89	3:80	3:71	3:63	3:55	3:47	3:40	3:33	3:26	3:19	3:12	3:06	3:00	61
62	4:36	4:25	4:15	4:05	3:96	3:87	3:78	3:70	3:62	3:54	3:47	3:39	3:32	3:25	3:18	3:12	62
63	4:54	4:43	4:33	4:22	4:13	4:03	3:94	3:86	3:77	3:69	3:61	3:54	3:46	3:39	3:32	3:26	63
64	4:74	4:62	4:51	4:41	4:31	4:21	4:11	4:02	3:94	3:85	3:77	3:69	3:61	3:54	3:47	3:40	64
65	4:95	4:83	4:72	4:61	4:50	4:40	4:30	4:20	4:11	4:02	3:94	3:86	3:78	3:70	3:62	3:55	65
66	5:18	5:05	4:93	4:82	4:71	4:60	4:50	4:40	4:30	4:21	4:12	4:03	3:95	3:87	3:79	3:71	66
67	5:42	5:29	5:17	5:04	4:93	4:82	4:71	4:61	4:51	4:41	4:31	4:22	4:13	4:05	3:97	3:89	67
68	5:69	5:55	5:42	5:29	5:17	5:05	4:94	4:83	4:73	4:62	4:53	4:43	4:34	4:25	4:16	4:08	68
69	5:98	5:83	5:69	5:56	5:43	5:31	5:19	5:07	4:97	4:86	4:75	4:65	4:56	4:47	4:38	4:29	69
70	6:29	6:14	5:99	5:85	5:72	5:59	5:46	5:34	5:23	5:11	5:00	4:90	4:80	4:70	4:60	4:51	70
71	6:63	6:47	6:32	6:17	6:03	5:89	5:76	5:63	5:51	5:39	5:28	5:17	5:06	4:96	4:86	4:76	71
72	7:01	6:84	6:68	6:52	6:37	6:23	6:09	5:96	5:83	5:70	5:58	5:46	5:35	5:24	5:13	5:03	72
73	7:43	7:25	7:08	6:91	6:75	6:60	6:45	6:31	6:17	6:04	5:91	5:79	5:67	5:55	5:44	5:33	73
74	7:90	7:71	7:52	7:35	7:18	7:01	6:86	6:71	6:56	6:42	6:28	6:15	6:03	5:90	5:78	5:67	74
75	8:42	8:22	8:02	7:83	7:65	7:48	7:31	7:15	6:99	6:84	6:70	6:56	6:42	6:29	6:16	6:04	75
76	9:01	8:79	8:58	8:38	8:19	8:00	7:82	7:65	7:49	7:32	7:17	7:02	6:87	6:73	6:60	6:46	76
77	9:68	9:45	9:22	9:01	8:80	8:60	8:41	8:22	8:04	7:87	7:71	7:54	7:39	7:24	7:09	6:95	77
78	10:5	10:2	9:96	9:73	9:51	9:29	9:08	8:88	8:69	8:50	8:32	8:15	7:98	7:81	7:66	7:50	78
79	11:4	11:1	10:8	10:6	10:3	10:1	9:86	9:65	9:44	9:23	9:04	8:85	8:67	8:49	8:32	8:15	79
80	12:4	12:1	11:8	11:6	11:3	11:0	10:8	10:6	10:3	10:1	9:88	9:68	9:48	9:28	9:09	8:91	80
81	13:7	13:4	13:0	12:7	12:4	12:2	11:9	11:6	11:4	11:1	10:9	10:7	10:4	10:3	10:0	9:82	81
82	15:2	14:9	14:5	14:2	13:9	13:5	13:2	13:0	12:7	12:4	12:1	11:9	11:6	11:4	11:2	10:9	82
83	17:2	16:8	16:4	16:0	15:6	15:3	14:9	14:6	14:3	14:0	13:7	13:4	13:1	12:8	12:6	12:3	83
83	19:7	19:2	18:7	18:3	17:9	17:5	17:1	16:7	16:3	16:0	15:7	15:3	15:0	14:7	14:4	14:1	83

HOUR ANGLE

A - Named opposite to Latitude, except when Hour Angle is between 90° and 270°.

A - Named opposite to Latitude, except when Hour Angle is between 90° and 270°.

TABLE B HOUR ANGLE

	Dec.	15° 00'	15° 30'	16° 00'	16° 30'	17° 00'	17° 30'	18° 00'	18° 30'	19° 00'	19° 30'	20° 00'	20° 30'	21° 00'	21° 30'	22° 00'	22° 30'	Dec.
	°	345° 00'	344° 30'	344° 00'	343° 30'	343° 00'	342° 30'	342° 00'	341° 30'	341° 00'	340° 30'	340° 00'	339° 30'	339° 00'	338° 30'	338° 00'	337° 30'	°
60	6-69	6-48	6-28	6-10	5-92	5-76	5-61	5-46	5-32	5-19	5-06	4-95	4-83	4-73	4-62	4-53	60	
61	6-97	6-75	6-55	6-35	6-17	6-00	5-84	5-69	5-54	5-40	5-27	5-15	5-03	4-92	4-82	4-71	61	
62	7-27	7-04	6-82	6-62	6-43	6-25	6-09	5-93	5-78	5-63	5-50	5-37	5-25	5-13	5-02	4-91	62	
63	7-58	7-34	7-12	6-91	6-71	6-53	6-35	6-19	6-03	5-88	5-74	5-60	5-48	5-36	5-24	5-13	63	
64	7-92	7-67	7-44	7-22	7-01	6-82	6-63	6-46	6-30	6-14	5-99	5-85	∞-72	5-59	5-47	5-36	64	
65	8-29	8-02	7-78	7-55	7-33	7-13	6-94	6-76	6-59	6-42	6-27	6-12	5-98	5-85	5-72	∞-60	65	
66	8-68	8-40	8-15	7-91	7-68	7-47	7-27	7-08	6-90	6-73	6-57	6-41	6-27	6-13	6-00	5-87	66	
67	9-10	8-82	8-55	8-29	8-06	7-83	7-62	7-42	7-24	7-06	6-89	6-73	6-57	6-43	6-29	6-16	67	
68	9-56	9-26	8-98	8-72	8-47	8-23	8-01	7-80	7-60	7-41	7-24	7-07	6-91	6-75	6-61	6-47	68	
69	10-1	9-75	9-45	9-17	8-91	8-66	8-43	8-21	8-00	7-80	7-62	7-44	7-27	7-11	6-95	6-81	69	
70	10-6	10-3	9-97	9-67	9-40	9-14	8-89	8-66	8-44	8-23	8-03	7-85	7-67	7-50	7-33	7-18	70	
71	11-2	10-9	10-5	10-2	9-93	9-66	9-40	9-15	8-92	8-70	8-49	8-29	8-10	7-92	7-75	7-59	71	
72	11-9	11-5	11-2	10-8	10-5	10-2	9-96	9-70	9-45	9-22	9-00	8-79	8-59	8-40	8-22	8-04	72	
73	12-6	12-2	11-9	11-5	11-2	10-9	10-6	10-3	10-0	9-80	9-57	9-34	9-13	8-93	8-73	8-55	73	
74	13-5	13-1	12-7	12-3	11-9	11-6	11-3	11-0	10-7	10-4	10-2	9-96	9-73	9-52	9-31	9-11	74	
75	14-4	14-0	13-5	13-1	12-8	12-4	12-1	11-8	11-5	11-2	10-9	10-7	10-4	10-2	9-96	9-75	75	
	Dec	165° 00'	164° 30'	164° 00'	163° 30'	163° 00'	162° 30'	162° 00'	161° 30'	161° 00'	160° 30'	160° 00'	159° 30'	159° 00'	158° 30'	158° 00'	157° 30'	Dec
	°	195° 00'	195° 30'	196° 00'	196° 30'	197° 00'	197° 30'	198° 00'	198° 30'	199° 00'	199° 30'	200° 00'	200° 30'	201° 00'	201° 30'	202° 00'	202° 30'	°

HOUR ANGLE

TABLE B - HOUR ANGLE

	Dec. °	22° 30'	23° 00'	23° 30'	24° 00'	24° 30'	25° 00'	25° 30'	26° 00'	26° 30'	27° 00'	27° 30'	28° 00'	28° 30'	29° 00'	29° 30'	30° 00'	Dec. °
60	4-53	4-43	4-34	4-26	4-18	4-10	4-02	3-95	3-88	3-82	3-75	3-69	3-63	3-57	3-52	3-46	60	
61	4-71	4-62	4-52	4-44	4-35	4-27	4-19	4-12	4-04	3-97	3-91	3-84	3-78	3-72	3-66	3-61	61	
62	4-91	4-81	4-72	4-62	4-54	4-45	4-37	4-29	4-22	4-14	4-07	4-01	3-94	3-88	3-82	3-76	62	
63	5-13	5-02	4-92	4-83	4-73	4-64	4-56	4-48	4-40	4-32	4-25	4-18	4-11	4-05	3-99	3-93	63	
64	5-36	5-25	5-14	5-04	4-94	4-85	4-76	4-68	4-60	4-52	4-44	4-37	4-30	4-23	4-16	4-10	64	
65	5-60	5-49	5-38	5-27	5-17	5-07	4-98	4-89	4-81	4-72	4-64	4-57	4-49	4-42	4-35	4-29	65	
66	5-87	5-75	5-63	5-52	5-42	5-31	5-22	5-12	5-03	4-95	4-86	4-78	4-71	4-63	4-56	4-49	66	
67	6-16	6-03	5-91	5-79	5-68	5-57	5-47	5-37	5-28	5-19	5-10	5-02	4-94	4-86	4-78	4-71	67	
68	6-47	6-33	6-21	6-09	5-97	5-86	5-75	5-65	5-55	5-45	5-36	5-27	5-19	5-11	5-03	4-95	68	
69	6-81	6-67	6-53	6-40	6-28	6-16	6-05	5-94	5-84	5-74	5-64	5-55	5-46	5-37	5-29	5-21	69	
70	7-18	7-03	6-89	6-75	6-63	6-50	6-38	6-27	6-16	6-05	5-95	5-85	5-76	5-67	5-58	5-49	70	
71	7-59	7-43	7-28	7-14	7-00	6-87	6-75	6-63	6-51	6-40	6-29	6-19	6-08	5-99	5-90	5-81	71	
72	8-04	7-88	7-72	7-57	7-42	7-28	7-15	7-02	6-90	6-78	6-67	6-56	6-45	6-35	6-25	6-15	72	
73	8-55	8-37	8-20	8-04	7-89	7-74	7-60	7-46	7-33	7-21	7-08	6-97	6-86	6-75	6-64	6-54	73	
74	9-11	8-93	8-75	8-57	8-41	8-25	8-10	7-96	7-82	7-68	7-55	7-43	7-31	7-19	7-08	6-97	74	
75	9-75	9-55	9-36	9-18	9-00	8-83	8-67	8-52	8-37	8-22	8-08	7-95	7-82	7-70	7-58	7-46	75	
	Dec.	157° 30'	157° 00'	156° 30'	156° 00'	155° 30'	155° 00'	154° 30'	154° 00'	153° 30'	153° 00'	152° 30'	152° 00'	151° 30'	151° 00'	150° 30'	150° 00'	Dec.
	202° 30'	203° 00'	203° 30'	204° 00'	204° 30'	205° 00'	205° 30'	206° 00'	206° 30'	207° 00'	207° 30'	208° 00'	208° 30'	209° 00'	209° 30'	210° 00'		

HOUR ANGLE

B - Always named the same as Declination

B

A Named opposite to Latitude, except when Hour Angle is between 90 and 270

TABLE A HOUR ANGLE																	
°	30°	31°	32°	33°	34°	35°	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	°
	330°	329°	328°	327°	326°	325°	324°	323°	322°	321°	320°	319°	318°	317°	316°	315°	
60	3-00	2-88	2-77	2-67	2-57	2-47	2-38	2-30	2-22	2-14	2-06	1-99	1-92	1-86	1-79	1-73	60
61	3-12	3-00	2-89	2-78	2-67	2-58	2-48	2-39	2-31	2-23	2-15	2-08	2-00	1-93	1-87	1-80	61
62	3-26	3-13	3-01	2-90	2-79	2-69	2-59	2-50	2-41	2-32	2-24	2-16	2-09	2-02	1-95	1-88	62
63	3-40	3-27	3-14	3-02	2-91	2-80	2-70	2-60	2-51	2-42	2-34	2-26	2-18	2-10	2-03	1-96	63
64	3-55	3-41	3-28	3-16	3-04	2-93	2-82	2-72	2-62	2-53	2-44	2-36	2-28	2-20	2-12	2-05	64
65	3-71	3-57	3-43	3-30	3-18	3-06	2-95	2-85	2-74	2-65	2-56	2-47	2-38	2-30	2-22	2-14	65
66	3-89	3-74	3-59	3-46	3-33	3-21	3-09	2-98	2-87	2-77	2-68	2-58	2-49	2-41	2-33	2-25	66
67	4-08	3-92	3-77	3-63	3-49	3-36	3-24	3-13	3-02	2-91	2-81	2-71	2-62	2-53	2-44	2-36	67
68	4-29	4-12	3-96	3-81	3-67	3-53	3-41	3-28	3-17	3-06	2-95	2-85	2-75	2-65	2-56	2-48	68
69	4-51	4-34	4-17	4-01	3-86	3-72	3-59	3-46	3-34	3-22	3-11	3-00	2-89	2-79	2-70	2-61	69
70	4-76	4-57	4-40	4-23	4-07	3-92	3-78	3-65	3-52	3-39	3-27	3-16	3-04	2-95	2-85	2-75	70
71	5-03	4-83	4-65	4-47	4-31	4-15	4-00	3-85	3-72	3-59	3-46	3-34	3-23	3-11	3-01	2-90	71
72	5-33	5-12	4-93	4-74	4-56	4-40	4-24	4-08	3-94	3-80	3-67	3-54	3-42	3-30	3-19	3-08	72
73	5-67	5-44	5-23	5-04	4-85	4-67	4-50	4-34	4-19	4-04	3-90	3-76	3-63	3-51	3-39	3-27	73
74	6-04	5-80	5-58	5-37	5-17	4-98	4-80	4-63	4-46	4-31	4-16	4-01	3-87	3-74	3-61	3-49	74
75	6-46	6-21	5-97	5-75	5-53	5-33	5-14	4-95	4-78	4-61	4-45	4-29	4-15	4-00	3-87	3-73	75
76	6-95	6-68	6-42	6-18	5-95	5-73	5-52	5-32	5-13	4-95	4-78	4-61	4-45	4-30	4-15	4-01	76
77	7-50	7-21	6-93	6-67	6-42	6-19	5-96	5-75	5-54	5-35	5-16	4-98	4-81	4-65	4-49	4-33	77
78	8-15	7-83	7-53	7-25	6-98	6-72	6-48	6-24	6-02	5-81	5-61	5-41	5-23	5-05	4-87	4-70	78
79	8-91	8-56	8-23	7-92	7-63	7-35	7-08	6-83	6-59	6-35	6-13	5-92	5-71	5-52	5-33	5-14	79
80	9-82	9-44	9-08	8-73	8-41	8-10	7-81	7-53	7-26	7-00	6-76	6-52	6-30	6-08	5-87	5-67	80
81	10-9	10-5	10-1	9-72	9-36	9-02	8-69	8-38	8-08	7-80	7-52	7-26	7-01	6-77	6-54	6-31	81
82	12-3	11-8	11-4	11-0	10-6	10-2	9-79	9-44	9-11	8-79	8-48	8-19	7-90	7-63	7-37	7-12	82
83	14-1	13-6	13-0	12-5	12-1	11-6	11-2	10-8	10-4	10-1	9-71	9-37	9-05	8-73	8-43	8-14	83
Lat.	150°	149°	148°	147°	146°	145°	144°	143°	142°	141°	140°	139°	138°	137°	136°	135°	Lat.
	210°	211°	212°	213°	214°	215°	216°	217°	218°	219°	220°	221°	222°	223°	224°	225°	

HOUR ANGLE

TABLE A HOUR ANGLE																	
Lat. °	45° 315°	46° 314°	47° 313°	48° 312°	49° 311°	50° 310°	51° 309°	52° 308°	53° 307°	54° 306°	55° 305°	56° 304°	57° 303°	58° 302°	59° 301°	60° 300°	Lat. °
60	1-73	1-67	1-62	1-56	1-51	1-45	1-40	1-35	1-31	1-26	1-21	1-17	1-12	1-08	1-04	1-00	60
61	1-80	1-74	1-68	1-62	1-57	1-51	1-46	1-41	1-36	1-31	1-26	1-22	1-17	1-13	1-08	1-04	61
62	1-88	1-82	1-75	1-69	1-63	1-58	1-52	1-47	1-42	1-37	1-32	1-27	1-22	1-18	1-13	1-09	62
63	1-96	1-90	1-83	1-77	1-71	1-65	1-59	1-53	1-48	1-43	1-37	1-32	1-27	1-23	1-18	1-13	63
64	2-05	1-98	1-91	1-85	1-78	1-72	1-66	1-60	1-55	1-49	1-44	1-38	1-33	1-28	1-23	1-18	64
65	2-14	2-07	2-00	1-93	1-86	1-80	1-74	1-68	1-62	1-56	1-50	1-45	1-39	1-34	1-29	1-24	65
66	2-25	2-17	2-09	2-02	1-95	1-88	1-82	1-75	1-69	1-63	1-57	1-52	1-46	1-40	1-35	1-30	66
67	2-36	2-28	2-20	2-12	2-05	1-98	1-91	1-84	1-78	1-71	1-65	1-59	1-53	1-47	1-42	1-36	67
68	2-48	2-39	2-31	2-23	2-15	2-08	2-00	1-93	1-87	1-80	1-73	1-67	1-61	1-55	1-49	1-43	68
69	2-61	2-52	2-43	2-35	2-26	2-19	2-11	2-04	1-96	1-89	1-82	1-76	1-69	1-63	1-57	1-50	69
70	2-75	2-65	2-56	2-47	2-39	2-31	2-23	2-15	2-07	2-00	1-92	1-85	1-78	1-72	1-65	1-59	70
71	2-90	2-80	2-71	2-62	2-52	2-44	2-35	2-27	2-19	2-11	2-03	1-96	1-89	1-82	1-75	1-68	71
72	3-08	2-97	2-87	2-77	2-68	2-58	2-49	2-41	2-32	2-24	2-16	2-08	2-00	1-92	1-85	1-78	72
73	3-27	3-16	3-05	2-95	2-84	2-74	2-65	2-56	2-47	2-38	2-29	2-21	2-12	2-04	1-97	1-89	73
74	3-49	3-37	3-25	3-14	3-03	2-93	2-82	2-73	2-63	2-53	2-44	2-35	2-27	2-18	2-10	2-01	74
75	3-73	3-60	3-48	3-36	3-24	3-13	3-02	2-92	2-81	2-71	2-61	2-52	2-42	2-33	2-24	2-16	75
76	4-01	3-87	3-74	3-61	3-49	3-37	3-25	3-13	3-02	2-91	2-81	2-71	2-61	2-51	2-41	2-32	76
77	4-33	4-18	4-04	3-90	3-77	3-64	3-51	3-38	3-26	3-15	3-03	2-92	2-81	2-71	2-60	2-50	77
78	4-70	4-54	4-39	4-24	4-09	3-95	3-81	3-68	3-55	3-42	3-29	3-17	3-06	2-94	2-83	2-72	78
79	5-14	4-97	4-80	4-63	4-47	4-32	4-17	4-02	3-88	3-74	3-60	3-47	3-34	3-22	3-09	2-97	79
80	5-67	5-48	5-29	5-11	4-93	4-76	4-59	4-43	4-27	4-12	3-97	3-83	3-68	3-54	3-41	3-27	80
81	6-31	6-10	5-89	5-69	5-49	5-30	5-11	4-93	4-76	4-59	4-42	4-26	4-10	3-95	3-79	3-65	81
82	7-12	6-87	6-64	6-41	6-19	5-97	5-76	5-56	5-36	5-17	4-98	4-80	4-62	4-45	4-28	4-11	82
83	8-14	7-86	7-60	7-33	7-08	6-83	6-60	6-36	6-14	5-92	5-70	5-49	5-29	5-09	4-89	4-70	83
Lat.	135° 225°	134° 226°	133° 227°	132° 228°	131° 229°	130° 230°	129° 231°	128° 232°	127° 233	126° 234°	125° 235°	124° 236°	123° 237°	122° 238	121° 239°	120° 240°	Lat.
HOUR ANGLE																	

HOUR ANGLE

A Named opposite to Latitude, except when Hour Angle is between 90 and 270

A

TABLE B HOUR ANGLE

Dec °	30° 31°	32° 33°	34° 35°	36° 37°	38° 39°	40° 41°	42° 43°	44° 45°	Dec °
	330° 329°	328° 327°	326° 325°	324° 323°	322° 321°	320° 319°	318° 317°	316° 315°	
60	3.46 3.36	3.27 3.18	3.10 3.02	2.95 2.88	2.81 2.75	2.69 2.64	2.59 2.54	2.49 2.45	60
61	3.61 3.50	3.40 3.31	3.23 3.15	3.07 3.00	2.93 2.87	2.81 2.75	2.70 2.65	2.60 2.55	61
62	3.76 3.65	3.55 3.45	3.36 3.28	3.20 3.13	3.05 2.99	2.93 2.87	2.81 2.76	2.71 2.66	62
63	3.93 3.81	3.70 3.60	3.51 3.42	3.34 3.26	3.19 3.12	3.05 2.99	2.93 2.88	2.83 2.78	63
64	4.10 3.98	3.87 3.76	3.67 3.57	3.49 3.41	3.33 3.26	3.19 3.13	3.06 3.01	2.95 2.90	64
65	4.29 4.16	4.05 3.94	3.84 3.74	3.65 3.56	3.48 3.41	3.34 3.27	3.20 3.14	3.09 3.03	65
66	4.49 4.36	4.24 4.12	4.02 3.92	3.82 3.73	3.65 3.57	3.49 3.42	3.36 3.29	3.23 3.18	66
67	4.71 4.57	4.45 4.33	4.21 4.11	4.01 3.91	3.83 3.74	3.67 3.59	3.52 3.45	3.39 3.33	67
68	4.95 4.81	4.67 4.54	4.43 4.32	4.21 4.11	4.02 3.93	3.85 3.77	3.70 3.63	3.56 3.50	68
69	5.21 5.06	4.92 4.78	4.66 4.54	4.43 4.33	4.23 4.14	4.05 3.97	3.89 3.82	3.75 3.68	69
70	5.49 5.33	5.18 5.04	4.91 4.79	4.67 4.56	4.46 4.37	4.27 4.19	4.11 4.03	3.95 3.89	70
71	5.81 5.64	5.48 5.33	5.19 5.06	4.94 4.83	4.72 4.61	4.52 4.43	4.34 4.26	4.18 4.11	71
72	6.15 5.98	5.81 5.65	5.50 5.37	5.24 5.11	5.00 4.89	4.79 4.69	4.60 4.51	4.43 4.35	72
73	6.54 6.35	6.17 6.01	5.85 5.70	5.57 5.44	5.31 5.20	5.09 4.99	4.89 4.80	4.71 4.63	73
74	6.97 6.77	6.58 6.40	6.24 6.08	5.93 5.79	5.67 5.54	5.43 5.32	5.21 5.11	5.02 4.93	74
75	7.46 7.25	7.04 6.85	6.67 6.51	6.35 6.20	6.06 5.93	5.81 5.69	5.58 5.47	5.37 5.28	75
Dec	150° 149°	148° 147°	146° 145°	144° 143°	142° 141°	140° 139°	138° 137°	136° 135°	Dec
	210° 211°	212° 213°	214° 215°	216° 217°	218° 219°	220° 221°	222° 223°	224° 225°	

HOUR ANGLE

TABLE B - HOUR ANGLE

Dec °	45° 46°	47° 48°	49° 50°	51° 52°	53° 54°	55° 56°	57° 58°	59° 60°	Dec °
	315° 314°	313° 312°	311° 310°	309° 308°	307° 306°	305° 304°	303° 302°	301° 300°	
60	2.45 2.41	2.37 2.33	2.29 2.26	2.23 2.20	2.17 2.14	2.11 2.09	2.07 2.04	2.02 2.00	60
61	2.55 2.51	2.47 2.43	2.39 2.36	2.32 2.29	2.26 2.23	2.20 2.18	2.15 2.13	2.10 2.08	61
62	2.66 2.62	2.57 2.53	2.49 2.46	2.42 2.39	2.35 2.32	2.30 2.27	2.24 2.22	2.19 2.17	62
63	2.78 2.73	2.68 2.64	2.60 2.56	2.53 2.49	2.46 2.43	2.40 2.36	2.34 2.31	2.29 2.27	63
64	2.90 2.85	2.80 2.76	2.72 2.68	2.64 2.60	2.57 2.53	2.50 2.47	2.44 2.42	2.39 2.37	64
65	3.03 2.98	2.93 2.89	2.84 2.80	2.76 2.72	2.69 2.65	2.62 2.59	2.56 2.53	2.50 2.48	65
66	3.18 3.12	3.07 3.02	2.98 2.93	2.89 2.85	2.81 2.78	2.74 2.71	2.68 2.65	2.62 2.59	66
67	3.33 3.28	3.22 3.17	3.12 3.08	3.03 2.99	2.95 2.91	2.88 2.84	2.81 2.78	2.75 2.72	67
68	3.50 3.44	3.38 3.33	3.28 3.23	3.18 3.14	3.10 3.06	3.02 2.99	2.95 2.92	2.89 2.86	68
69	3.68 3.62	3.56 3.51	3.45 3.40	3.35 3.31	3.26 3.22	3.18 3.14	3.11 3.07	3.04 3.01	69
70	3.89 3.82	3.76 3.70	3.64 3.59	3.54 3.49	3.44 3.40	3.35 3.31	3.28 3.24	3.20 3.17	70
71	4.11 4.04	3.97 3.91	3.85 3.79	3.74 3.68	3.64 3.59	3.54 3.50	3.46 3.42	3.39 3.35	71
72	4.35 4.28	4.21 4.14	4.08 4.02	3.96 3.91	3.85 3.80	3.76 3.71	3.67 3.63	3.59 3.55	72
73	4.63 4.55	4.47 4.40	4.33 4.27	4.21 4.15	4.10 4.04	3.99 3.95	3.90 3.86	3.82 3.78	73
74	4.93 4.85	4.77 4.69	4.62 4.55	4.49 4.43	4.37 4.31	4.26 4.21	4.16 4.11	4.07 4.03	74
75	5.28 5.19	5.10 5.02	4.95 4.87	4.80 4.74	4.67 4.61	4.56 4.50	4.45 4.40	4.35 4.31	75
Dec	135° 134°	133° 132°	131° 130°	129° 128°	127° 126°	125° 124°	123° 122°	121° 120°	Dec
	225° 226°	227° 228°	229° 230°	231° 232°	233° 234°	235° 236°	237° 238°	239° 240°	

HOUR ANGLE

B - Always named the same as Declination

B - Always named the same as Declination

B

TABLE A HOUR ANGLE

Lat °	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	72°	73°	74°	75°	Lat °
	300°	299°	298°	297°	296°	295°	294°	293°	292°	291°	290°	289°	288°	287°	286°	285°	
60	1.00	.96	.92	.88	.85	.81	.77	.74	.70	.67	.63	.60	.56	.53	.50	.46	60
61	1.04	1.00	.96	.92	.88	.84	.80	.77	.73	.69	.66	.62	.59	.55	.52	.48	61
62	1.09	1.04	1.00	.96	.92	.88	.84	.80	.76	.72	.68	.65	.61	.58	.54	.50	62
63	1.13	1.09	1.04	1.00	.96	.92	.87	.83	.79	.75	.71	.68	.64	.60	.56	.53	63
64	1.18	1.14	1.09	1.05	1.00	.96	.91	.87	.83	.79	.75	.71	.67	.63	.59	.55	64
65	1.24	1.19	1.14	1.09	1.05	1.00	.96	.91	.87	.82	.78	.74	.70	.66	.62	.57	65
66	1.30	1.25	1.19	1.14	1.10	1.05	1.00	.95	.91	.86	.82	.77	.73	.69	.64	.60	66
67	1.36	1.31	1.25	1.20	1.15	1.10	1.05	1.00	.95	.90	.86	.81	.77	.72	.68	.63	67
68	1.43	1.37	1.32	1.26	1.21	1.15	1.09	1.05	1.00	.95	.90	.85	.80	.76	.71	.66	68
69	1.50	1.44	1.39	1.33	1.27	1.22	1.16	1.11	1.05	1.00	.95	.90	.85	.80	.75	.70	69
70	1.59	1.52	1.46	1.40	1.34	1.28	1.22	1.17	1.11	1.05	1.00	.95	.89	.84	.79	.74	70
71	1.68	1.61	1.54	1.48	1.42	1.35	1.29	1.23	1.17	1.11	1.06	1.00	.94	.89	.83	.78	71
72	1.78	1.71	1.64	1.57	1.50	1.44	1.37	1.31	1.24	1.18	1.12	1.06	1.00	.94	.88	.82	72
73	1.89	1.81	1.74	1.67	1.60	1.53	1.46	1.39	1.32	1.26	1.19	1.13	1.06	1.00	.94	.88	73
74	2.01	1.93	1.85	1.78	1.70	1.63	1.55	1.48	1.41	1.34	1.27	1.20	1.13	1.07	1.00	.93	74
75	2.16	2.07	1.98	1.90	1.82	1.74	1.66	1.58	1.51	1.43	1.36	1.29	1.21	1.14	1.07	1.00	75
76	2.32	2.22	2.13	2.04	1.96	1.87	1.79	1.70	1.62	1.54	1.46	1.38	1.30	1.23	1.15	1.07	76
77	2.50	2.40	2.30	2.21	2.11	2.02	1.93	1.84	1.75	1.66	1.58	1.49	1.41	1.32	1.24	1.16	77
78	2.72	2.61	2.50	2.40	2.29	2.19	2.09	2.00	1.90	1.81	1.71	1.62	1.53	1.44	1.35	1.26	78
79	2.97	2.85	2.74	2.62	2.51	2.40	2.29	2.18	2.08	1.97	1.87	1.77	1.67	1.57	1.48	1.37	79
80	3.27	3.14	3.02	2.89	2.77	2.64	2.53	2.41	2.29	2.18	2.06	1.95	1.84	1.73	1.63	1.52	80
81	3.65	3.50	3.36	3.22	3.08	2.94	2.81	2.68	2.55	2.42	2.30	2.17	2.05	1.93	1.81	1.69	81
82	4.11	3.94	3.78	3.63	3.47	3.32	3.17	3.02	2.87	2.73	2.59	2.45	2.31	2.18	2.04	1.91	82
83	4.70	4.51	4.33	4.15	3.97	3.80	3.63	3.46	3.29	3.13	2.96	2.80	2.65	2.49	2.34	2.18	83

A - Named opposite to Latitude, except when Hour Angle is between 90° and 270°

HOUR ANGLE

TABLE A HOUR ANGLE

Lat °	75°	76°	77°	78°	79°	80°	81°	82°	83°	84°	85°	86°	87°	88°	89°	90°	Lat °
	285°	284°	283°	282°	281°	280°	279°	278°	277°	276°	275°	274°	273°	272°	271°	270°	
60	.46	.43	.40	.37	.34	.31	.27	.24	.21	.18	.15	.12	.09	.06	.03	.00	60
61	.48	.45	.42	.38	.35	.32	.29	.25	.22	.19	.16	.13	.10	.06	.03	.00	61
62	.50	.47	.43	.40	.37	.33	.30	.26	.23	.20	.16	.13	.10	.07	.03	.00	62
63	.53	.49	.45	.42	.38	.35	.31	.28	.24	.21	.17	.14	.10	.07	.03	.00	63
64	.55	.51	.47	.44	.40	.36	.33	.29	.25	.22	.18	.14	.11	.07	.04	.00	64
65	.57	.54	.50	.46	.42	.38	.34	.30	.26	.23	.19	.15	.11	.08	.04	.00	65
66	.60	.56	.52	.48	.44	.40	.36	.32	.28	.24	.20	.16	.12	.08	.04	.00	66
67	.63	.59	.54	.50	.46	.42	.37	.33	.29	.25	.21	.17	.12	.08	.04	.00	67
68	.66	.62	.57	.53	.48	.44	.39	.35	.30	.26	.22	.17	.13	.09	.04	.00	68
69	.70	.65	.60	.55	.51	.46	.41	.37	.32	.27	.23	.18	.14	.09	.05	.00	69
70	.74	.69	.63	.58	.53	.48	.44	.39	.34	.29	.24	.19	.14	.10	.05	.00	70
71	.78	.72	.67	.62	.57	.51	.46	.41	.36	.31	.25	.20	.15	.10	.05	.00	71
72	.82	.77	.71	.65	.60	.54	.49	.43	.38	.32	.27	.22	.16	.11	.05	.00	72
73	.88	.82	.78	.70	.64	.58	.52	.46	.40	.34	.29	.23	.17	.11	.06	.00	73
74	.93	.87	.81	.74	.68	.61	.55	.49	.43	.37	.31	.24	.18	.12	.06	.00	74
75	1.00	.93	.86	.79	.73	.66	.59	.53	.46	.39	.33	.26	.20	.13	.07	.00	75
76	1.07	1.00	.93	.85	.78	.71	.64	.56	.49	.42	.35	.28	.21	.14	.07	.00	76
77	1.16	1.08	1.00	.92	.84	.76	.69	.61	.53	.46	.38	.30	.23	.15	.08	.00	77
78	1.26	1.17	1.09	1.00	.91	.83	.75	.66	.58	.49	.41	.33	.25	.16	.08	.00	78
79	1.37	1.28	1.19	1.09	1.00	.91	.82	.72	.63	.54	.45	.36	.27	.18	.09	.00	79
80	1.52	1.41	1.31	1.21	1.10	1.00	.90	.80	.70	.60	.50	.40	.30	.20	.10	.00	80
81	1.69	1.57	1.46	1.34	1.23	1.11	1.00	.89	.78	.66	.55	.44	.33	.22	.11	.00	81
82	1.91	1.77	1.64	1.51	1.38	1.26	1.13	1.00	.87	.75	.62	.50	.37	.25	.12	.00	82
83	2.18	2.03	1.88	1.73	1.58	1.44	1.29	1.15	1.00	.86	.71	.57	.43	.28	.14	.00	83

A - Named opposite to Latitude, except when Hour Angle is between 90° and 270°

HOUR ANGLE

TABLE B HOUR ANGLE

Dec °	60° 300°	61° 299°	62° 298°	63° 297°	64° 296°	65° 295°	66° 294°	67° 293°	68° 292°	69° 291°	70° 290°	71° 289°	72° 288°	73° 287°	74° 286°	75° 285°	Dec °
60	2.00	1.98	1.96	1.94	1.93	1.91	1.89	1.88	1.87	1.86	1.84	1.83	1.82	1.81	1.80	1.79	60
61	2.08	2.06	2.04	2.03	2.01	1.99	1.98	1.96	1.95	1.93	1.92	1.91	1.90	1.89	1.88	1.87	61
62	2.17	2.15	2.13	2.11	2.09	2.08	2.06	2.04	2.03	2.01	2.00	1.99	1.98	1.97	1.96	1.95	62
63	2.27	2.24	2.22	2.20	2.18	2.17	2.15	2.13	2.12	2.10	2.09	2.08	2.06	2.05	2.04	2.03	63
64	2.37	2.34	2.32	2.30	2.28	2.26	2.24	2.23	2.21	2.20	2.18	2.16	2.16	2.14	2.13	2.12	64
65	2.48	2.45	2.43	2.41	2.39	2.37	2.35	2.33	2.31	2.30	2.28	2.27	2.25	2.24	2.23	2.22	65
66	2.59	2.57	2.54	2.52	2.50	2.48	2.46	2.44	2.42	2.41	2.39	2.38	2.36	2.35	2.34	2.33	66
67	2.72	2.69	2.67	2.64	2.62	2.60	2.58	2.56	2.54	2.52	2.51	2.49	2.48	2.46	2.45	2.44	67
68	2.86	2.83	2.80	2.78	2.75	2.73	2.71	2.69	2.67	2.65	2.63	2.62	2.60	2.59	2.57	2.56	68
69	3.01	2.98	2.95	2.92	2.90	2.87	2.85	2.83	2.81	2.79	2.77	2.76	2.74	2.72	2.71	2.70	69
70	3.17	3.14	3.11	3.08	3.06	3.03	3.01	2.98	2.96	2.94	2.92	2.91	2.89	2.87	2.86	2.84	70
71	3.35	3.32	3.29	3.26	3.23	3.20	3.18	3.16	3.13	3.11	3.09	3.07	3.05	3.04	3.02	3.01	71
72	3.55	3.52	3.49	3.45	3.42	3.40	3.37	3.34	3.32	3.30	3.28	3.26	3.24	3.22	3.20	3.19	72
73	3.78	3.74	3.70	3.67	3.64	3.61	3.58	3.55	3.53	3.50	3.48	3.46	3.44	3.42	3.40	3.39	73
74	4.03	3.99	3.95	3.91	3.88	3.85	3.82	3.79	3.76	3.74	3.71	3.69	3.67	3.65	3.63	3.61	74
75	4.31	4.27	4.23	4.19	4.15	4.12	4.09	4.05	4.03	4.00	3.97	3.95	3.92	3.90	3.88	3.86	75
Dec °	120° 240°	119° 241°	118° 242°	117° 243°	116° 244°	115° 245°	114° 246°	113° 247°	112° 248°	111° 249°	110° 250°	109° 251°	108° 252°	107° 253°	106° 254°	105° 255°	Dec °

HOUR ANGLE

TABLE B - HOUR ANGLE

Dec °	75° 285°	76° 284°	77° 283°	78° 282°	79° 281°	80° 280°	81° 279°	82° 278°	83° 277°	84° 276°	85° 275°	86° 274°	87° 273°	88° 272°	89° 271°	90° 270°	Dec °
60	1.79	1.79	1.78	1.77	1.76	1.76	1.75	1.75	1.75	1.74	1.74	1.74	1.73	1.73	1.73	1.73	60
61	1.87	1.86	1.85	1.84	1.84	1.83	1.83	1.82	1.82	1.81	1.81	1.81	1.81	1.80	1.80	1.80	61
62	1.95	1.94	1.93	1.92	1.92	1.91	1.90	1.90	1.89	1.89	1.89	1.89	1.88	1.88	1.88	1.88	62
63	2.03	2.02	2.01	2.01	2.00	1.99	1.99	1.98	1.98	1.97	1.97	1.97	1.97	1.96	1.96	1.96	63
64	2.12	2.11	2.10	2.10	2.09	2.08	2.08	2.07	2.07	2.06	2.06	2.06	2.05	2.05	2.05	2.05	64
65	2.22	2.21	2.20	2.19	2.18	2.18	2.17	2.17	2.16	2.16	2.15	2.15	2.15	2.14	2.14	2.14	65
66	2.33	2.31	2.31	2.30	2.29	2.28	2.27	2.27	2.26	2.26	2.25	2.25	2.25	2.25	2.25	2.25	66
67	2.44	2.43	2.42	2.41	2.40	2.39	2.39	2.38	2.37	2.37	2.36	2.36	2.36	2.36	2.36	2.36	67
68	2.56	2.55	2.54	2.53	2.52	2.51	2.51	2.50	2.49	2.49	2.48	2.48	2.48	2.48	2.48	2.48	68
69	2.70	2.68	2.67	2.66	2.65	2.65	2.64	2.63	2.62	2.62	2.62	2.61	2.61	2.61	2.61	2.61	69
70	2.84	2.83	2.82	2.81	2.80	2.79	2.78	2.78	2.77	2.76	2.76	2.75	2.75	2.75	2.75	2.75	70
71	3.01	2.99	2.98	2.97	2.96	2.95	2.94	2.93	2.93	2.92	2.92	2.91	2.91	2.90	2.90	2.90	71
72	3.19	3.17	3.16	3.15	3.14	3.13	3.12	3.11	3.10	3.09	3.09	3.09	3.08	3.08	3.08	3.08	72
73	3.39	3.37	3.36	3.34	3.33	3.32	3.31	3.30	3.30	3.29	3.28	3.28	3.28	3.27	3.27	3.27	73
74	3.61	3.59	3.58	3.57	3.55	3.54	3.53	3.52	3.51	3.51	3.50	3.50	3.49	3.49	3.49	3.49	74
75	3.86	3.85	3.83	3.82	3.80	3.79	3.78	3.77	3.76	3.75	3.75	3.74	3.74	3.73	3.73	3.73	75
Dec °	105° 255°	104° 256°	103° 257°	102° 258°	101° 259°	100° 260°	99° 261°	98° 262°	97° 263°	96° 264°	95° 265°	94° 266°	93° 267°	92° 268°	91° 269°	90° 270°	Dec °

HOUR ANGLE

B - Always named the same as Declination

B - Always named the same as Declination

TABLE C

$A \pm B = -00'$		-01'		-02'		-03'		-04'		-05'		A & B CORRECTION.				-10'		-11'		-12'		-13'		-14'		-15' = $A \pm B$	
												AZIMUTHS															
0	90.0	89.4	88.9	88.3	87.7	87.1	86.6	86.0	85.4	84.9	84.3	83.7	83.2	82.6	82.0	81.5	0										
5	90.0	89.4	88.9	88.3	87.7	87.1	86.6	86.0	85.4	84.9	84.3	83.7	83.2	82.6	82.1	81.5	5										
10	90.0	89.4	88.9	88.3	87.7	87.2	86.6	86.1	85.5	84.9	84.4	83.8	83.3	82.7	82.1	81.6	10										
14	90.0	89.5	88.9	88.3	87.8	87.2	86.7	86.1	85.6	85.0	84.4	83.9	83.4	82.8	82.3	81.7	14										
18	90.0	89.5	88.9	88.4	87.8	87.3	86.7	86.2	85.6	85.1	84.5	84.0	83.5	83.0	82.4	81.9	18										
20	90.0	89.5	88.9	88.4	87.8	87.3	86.8	86.2	85.7	85.2	84.6	84.1	83.6	83.0	82.5	82.0	20										
22	90.0	89.5	88.9	88.4	87.9	87.3	86.8	86.3	85.8	85.2	84.7	84.2	83.7	83.1	82.6	82.1	22										
24	90.0	89.5	89.0	88.4	87.9	87.4	86.9	86.3	85.8	85.3	84.8	84.3	83.7	83.2	82.7	82.2	24										
26	90.0	89.5	89.0	88.5	87.9	87.4	86.9	86.4	85.9	85.4	84.9	84.4	83.8	83.3	82.8	82.3	26										
28	90.0	89.5	89.0	88.5	88.0	87.5	87.0	86.5	86.0	85.5	85.0	84.5	84.0	83.5	83.0	82.5	28										
30	90.0	89.5	89.0	88.5	88.0	87.5	87.0	86.5	86.0	85.5	85.1	84.6	84.1	83.6	83.1	82.6	30										
31	90.0	89.5	89.0	88.5	88.0	87.5	87.1	86.6	86.1	85.6	85.1	84.6	84.1	83.6	83.2	82.7	31										
32	90.0	89.5	89.0	88.5	88.1	87.6	87.1	86.6	86.1	85.6	85.2	84.7	84.2	83.7	83.2	82.8	32										
33	90.0	89.5	89.1	88.6	88.1	87.6	87.1	86.6	86.2	85.7	85.2	84.7	84.3	83.8	83.3	82.8	33										
34	90.0	89.5	89.1	88.6	88.1	87.6	87.2	86.7	86.2	85.7	85.3	84.8	84.3	83.8	83.4	82.9	34										
35	90.0	89.5	89.1	88.6	88.1	87.7	87.2	86.7	86.3	85.8	85.3	84.9	84.4	83.9	83.5	83.0	35										
36	90.0	89.5	89.1	88.6	88.1	87.7	87.2	86.8	86.3	85.8	85.4	84.9	84.5	84.0	83.5	83.1	36										
37	90.0	89.5	89.1	88.6	88.2	87.7	87.3	86.8	86.3	85.9	85.4	85.0	84.5	84.1	83.6	83.2	37										
38	90.0	89.5	89.1	88.6	88.2	87.7	87.3	86.8	86.4	85.9	85.5	85.0	84.6	84.2	83.7	83.3	38										
39	90.0	89.6	89.1	88.7	88.2	87.8	87.3	86.9	86.4	86.0	85.6	85.1	84.7	84.2	83.8	83.4	39										
40	90.0	89.6	89.1	88.7	88.2	87.8	87.4	86.9	86.5	86.1	85.6	85.2	84.7	84.3	83.9	83.4	40										
41	90.0	89.6	89.1	88.7	88.3	87.8	87.4	87.0	86.5	86.1	85.7	85.3	84.8	84.4	84.0	83.5	41										
42	90.0	89.6	89.1	88.7	88.3	87.9	87.4	87.0	86.6	86.2	85.7	85.3	84.9	84.5	84.1	83.6	42										
43	90.0	89.6	89.2	88.7	88.3	87.9	87.5	87.1	86.7	86.2	85.8	85.4	85.0	84.6	84.2	83.7	43										
44	90.0	89.6	89.2	88.8	88.4	87.9	87.5	87.1	86.7	86.3	85.9	85.5	85.1	84.7	84.2	83.8	44										
45	90.0	89.6	89.2	88.8	88.4	88.0	87.6	87.2	86.8	86.4	86.0	85.6	85.1	84.7	84.3	83.9	45										
46	90.0	89.6	89.2	88.8	88.4	88.0	87.6	87.2	86.8	86.4	86.0	85.6	85.2	84.8	84.4	84.1	46										
47	90.0	89.6	89.2	88.8	88.4	88.0	87.7	87.3	86.9	86.5	86.1	85.7	85.3	84.9	84.5	84.2	47										
48	90.0	89.6	89.2	88.9	88.5	88.1	87.7	87.3	86.9	86.6	86.2	85.8	85.4	85.0	84.6	84.3	48										
49	90.0	89.6	89.2	88.9	88.5	88.1	87.7	87.4	87.0	86.6	86.2	85.9	85.5	85.1	84.8	84.4	49										
50	90.0	89.6	89.3	88.9	88.5	88.2	87.8	87.4	87.1	86.7	86.3	86.0	85.6	85.2	84.9	84.5	50										
51	90.0	89.6	89.3	88.9	88.6	88.2	87.8	87.5	87.1	86.8	86.4	86.0	85.7	85.3	85.0	84.6	51										
52	90.0	89.6	89.3	88.9	88.6	88.2	87.9	87.5	87.2	86.8	86.5	86.1	85.8	85.4	85.1	84.7	52										
53	90.0	89.7	89.3	89.0	88.6	88.3	87.9	87.6	87.2	86.9	86.6	86.2	85.9	85.5	85.2	84.8	53										
54	90.0	89.7	89.3	89.0	88.7	88.3	88.0	87.6	87.3	87.0	86.6	86.3	86.0	85.6	85.3	85.0	54										
55	90.0	89.7	89.3	89.0	88.7	88.4	88.0	87.7	87.4	87.0	86.7	86.4	86.1	85.7	85.4	85.1	55										
56	90.0	89.7	89.4	89.0	88.7	88.4	88.1	87.8	87.4	87.1	86.8	86.5	86.2	85.8	85.5	85.2	56										
57	90.0	89.7	89.4	89.1	88.8	88.4	88.1	87.8	87.5	87.2	86.9	86.6	86.3	86.0	85.6	85.3	57										
58	90.0	89.7	89.4	89.1	88.8	88.5	88.2	87.9	87.6	87.3	87.0	86.7	86.4	86.1	85.8	85.5	58										
59	90.0	89.7	89.4	89.1	88.8	88.5	88.2	87.9	87.6	87.3	87.1	86.8	86.5	86.2	85.9	85.6	59										
60	90.0	89.7	89.4	89.1	88.9	88.6	88.3	88.0	87.7	87.4	87.1	86.9	86.6	86.3	86.0	85.7	60										
61	90.0	89.7	89.4	89.2	88.9	88.6	88.3	88.1	87.8	87.5	87.2	86.9	86.7	86.4	86.1	85.8	61										
62	90.0	89.7	89.5	89.2	88.9	88.7	88.4	88.1	87.8	87.6	87.3	87.0	86.8	86.5	86.2	86.0	62										
63	90.0	89.7	89.5	89.2	89.0	88.7	88.4	88.2	87.9	87.7	87.4	87.1	86.9	86.6	86.4	86.1	63										
64	90.0	89.7	89.5	89.2	89.0	88.7	88.5	88.2	88.0	87.7	87.5	87.2	87.0	86.7	86.5	86.2	64										
65	90.0	89.8	89.5	89.3	89.0	88.8	88.5	88.3	88.1	87.8	87.6	87.3	87.1	86.9	86.6	86.4	65										
66	90.0	89.8	89.5	89.3	89.1	88.8	88.6	88.4	88.1	87.9	87.7	87.4	87.2	87.0	86.7	86.5	66										
67	90.0	89.8	89.6	89.3	89.1	88.9	88.7	88.4	88.2	88.0	87.8	87.5	87.3	87.1	86.9	86.6	67										
68	90.0	89.8	89.6	89.4	89.1	88.9	88.7	88.5	88.3	88.1	87.9	87.6	87.4	87.2	87.0	86.8	68										

A & B Same Names } RULE TO FIND { A & B Different names
 take Sum, (add) } C CORRECTION { take Difference (Sub.)
 C CORRECTION, ($A \pm B$) is named the same as the greater of these quantities.
 AZIMUTH takes combined names of C Correction and Hour Angle

TABLE C

A ± B = '15' '16'		'17' '18'		'19' '20'		A & B CORRECTION.				'25' '26'		'27' '28'		'29' '30' = A ± B			
						'21'	'22'	'23'	'24'								
AZIMUTHS																	
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	Lat
0	81.5	80.9	80.4	79.8	79.2	78.7	78.1	77.6	77.0	76.5	76.0	75.4	74.9	74.4	73.8	73.3	0
5	81.5	80.9	80.4	79.8	79.3	78.7	78.2	77.6	77.1	76.6	76.0	75.5	74.9	74.4	73.9	73.4	5
10	81.6	81.0	80.5	79.9	79.4	78.9	78.3	77.8	77.2	76.7	76.2	75.6	75.1	74.6	74.1	73.5	10
14	81.7	81.2	80.6	80.1	79.6	79.1	78.5	78.0	77.4	76.9	76.4	75.8	75.3	74.8	74.3	73.7	14
18	81.9	81.3	80.8	80.3	79.8	79.2	78.7	78.2	77.7	77.1	76.6	76.1	75.6	75.1	74.6	74.1	18
20	82.0	81.4	80.9	80.4	79.9	79.4	78.8	78.3	77.8	77.3	76.8	76.3	75.8	75.3	74.8	74.3	20
22	82.1	81.6	81.0	80.5	80.0	79.5	79.0	78.5	78.0	77.5	76.9	76.4	75.9	75.4	75.0	74.5	22
24	82.2	81.7	81.2	80.7	80.2	79.6	79.1	78.6	78.1	77.6	77.1	76.6	76.1	75.7	75.2	74.7	24
26	82.3	81.8	81.3	80.8	80.3	79.8	79.3	78.8	78.3	77.8	77.3	76.8	76.4	75.9	75.4	74.9	26
28	82.5	82.0	81.5	81.0	80.5	80.0	79.5	79.0	78.5	78.0	77.6	77.1	76.6	76.1	75.6	75.2	28
30	82.6	82.1	81.6	81.1	80.7	80.2	79.7	79.2	78.7	78.3	77.8	77.3	76.8	76.4	75.9	75.4	30
31	82.7	82.2	81.7	81.2	80.7	80.3	79.8	79.3	78.8	78.4	77.9	77.4	77.0	76.5	76.0	75.6	31
32	82.8	82.3	81.8	81.3	80.8	80.4	79.9	79.4	79.0	78.5	78.0	77.6	77.1	76.6	76.2	75.7	32
33	82.8	82.4	81.9	81.4	80.9	80.5	80.0	79.5	79.1	78.6	78.2	77.7	77.2	76.8	76.3	75.9	33
34	82.9	82.4	82.0	81.5	81.0	80.6	80.1	79.7	79.2	78.7	78.3	77.8	77.4	76.9	76.5	76.0	34
35	83.0	82.5	82.1	81.6	81.2	80.7	80.2	79.8	79.3	78.9	78.4	78.0	77.5	77.1	76.6	76.2	35
36	83.1	82.6	82.2	81.7	81.3	80.8	80.4	79.9	79.5	79.0	78.6	78.1	77.7	77.2	76.8	76.4	36
37	83.2	82.7	82.3	81.8	81.4	80.9	80.5	80.0	79.6	79.1	78.7	78.3	77.8	77.4	77.0	76.5	37
38	83.3	82.8	82.4	81.9	81.5	81.0	80.6	80.2	79.7	79.3	78.9	78.4	78.0	77.6	77.1	76.7	38
39	83.4	82.9	82.5	82.0	81.6	81.2	80.7	80.3	79.9	79.4	79.0	78.6	78.1	77.7	77.3	76.9	39
40	83.4	83.0	82.6	82.1	81.7	81.3	80.9	80.4	80.0	79.6	79.2	78.7	78.3	77.9	77.5	77.1	40
41	83.5	83.1	82.7	82.3	81.8	81.4	81.0	80.6	80.2	79.7	79.3	78.9	78.5	78.1	77.7	77.2	41
42	83.6	83.2	82.8	82.4	82.0	81.5	81.1	80.7	80.3	79.9	79.5	79.1	78.7	78.2	77.8	77.4	42
43	83.7	83.3	82.9	82.5	82.1	81.7	81.3	80.9	80.5	80.0	79.6	79.2	78.8	78.4	78.0	77.6	43
44	83.8	83.4	83.0	82.6	82.2	81.8	81.4	81.0	80.6	80.2	79.8	79.4	79.0	78.6	78.2	77.8	44
45	83.9	83.5	83.1	82.7	82.3	82.0	81.6	81.2	80.8	80.4	80.0	79.6	79.2	78.8	78.4	78.0	45
46	84.1	83.7	83.3	82.9	82.5	82.1	81.7	81.3	80.9	80.5	80.1	79.8	79.4	79.0	78.6	78.2	46
47	84.2	83.8	83.4	83.0	82.6	82.2	81.8	81.5	81.1	80.7	80.3	79.9	79.6	79.2	78.8	78.4	47
48	84.3	83.9	83.5	83.1	82.8	82.4	82.0	81.6	81.3	80.9	80.5	80.1	79.8	79.4	79.0	78.6	48
49	84.4	84.0	83.6	83.3	82.9	82.5	82.2	81.8	81.4	81.1	80.7	80.3	80.0	79.6	79.2	78.9	49
50	84.5	84.1	83.8	83.4	83.0	82.7	82.3	82.0	81.6	81.2	80.9	80.5	80.2	79.8	79.4	79.1	50
51	84.6	84.3	83.9	83.5	83.2	82.8	82.5	82.1	81.8	81.4	81.1	80.7	80.4	80.0	79.7	79.3	51
52	84.7	84.4	84.0	83.7	83.3	83.0	82.6	82.3	81.9	81.6	81.2	80.9	80.6	80.2	79.9	79.5	52
53	84.8	84.5	84.2	83.8	83.5	83.1	82.8	82.5	82.1	81.8	81.4	81.1	80.8	80.4	80.1	79.8	53
54	85.0	84.6	84.3	84.0	83.6	83.3	83.0	82.6	82.3	82.0	81.6	81.3	81.0	80.7	80.3	80.0	54
55	85.1	84.8	84.4	84.1	83.8	83.5	83.1	82.8	82.5	82.2	81.8	81.5	81.2	80.9	80.6	80.2	55
56	85.2	84.9	84.6	84.3	83.9	83.6	83.3	83.0	82.7	82.4	82.0	81.7	81.4	81.1	80.8	80.5	56
57	85.3	85.0	84.7	84.4	84.1	83.8	83.5	83.2	82.9	82.6	82.2	81.9	81.6	81.3	81.0	80.7	57
58	85.5	85.2	84.9	84.6	84.3	84.0	83.7	83.4	83.1	82.8	82.5	82.2	81.9	81.6	81.3	81.0	58
59	85.6	85.3	85.0	84.7	84.4	84.1	83.8	83.5	83.2	83.0	82.7	82.4	82.1	81.8	81.5	81.2	59
60	85.7	85.4	85.1	84.9	84.6	84.3	84.0	83.7	83.4	83.2	82.9	82.6	82.3	82.0	81.7	81.5	60
61	85.8	85.6	85.3	85.0	84.7	84.5	84.2	83.9	83.6	83.4	83.1	82.8	82.5	82.3	82.0	81.7	61
62	86.0	85.7	85.4	85.2	84.9	84.6	84.4	84.1	83.8	83.6	83.3	83.0	82.8	82.5	82.2	82.0	62
63	86.1	85.8	85.6	85.3	85.1	84.8	84.6	84.3	84.0	83.8	83.5	83.3	83.0	82.8	82.5	82.2	63
64	86.2	86.0	85.7	85.5	85.2	85.0	84.7	84.5	84.2	84.0	83.7	83.5	83.2	83.0	82.8	82.5	64
65	86.4	86.1	85.9	85.6	85.4	85.2	84.9	84.7	84.4	84.2	84.0	83.7	83.5	83.3	83.0	82.8	65
66	86.5	86.3	86.0	85.8	85.6	85.3	85.1	84.9	84.7	84.4	84.2	84.0	83.7	83.5	83.3	83.0	66
67	86.6	86.4	86.2	86.0	85.8	85.5	85.3	85.1	84.9	84.6	84.4	84.2	84.0	83.8	83.5	83.3	67
68	86.8	86.6	86.4	86.1	85.9	85.7	85.5	85.3	85.1	84.9	84.6	84.4	84.2	84.0	83.8	83.6	68

A ± B = '15' '16' '17' '18' '19' '20' '21' '22' '23' '24' '25' '26' '27' '28' '29' '30' = A ± B

A & B Same Names } RULE TO FIND { A & B Different names
 take Sum. (add) } C CORRECTION { take Difference (Sub.)
 C CORRECTION, (A ± B) is named the same as the greater of these quantities.
 AZIMUTH takes combined names of C Correction and Hour Angle

TABLE C

A ± B = -30' -31' -32' -33' -34' -35'						A. & B. CORRECTION.										A ± B	
						36'	37'	38'	39'	40'	41'	42'	43'	44'	45'		
AZIMUTHS																	
Lat	0	5	10	14	18	20	22	24	26	28	30	31	32	33	34	35	Lat
	73.3	72.8	72.3	71.7	71.2	70.7	70.2	69.7	69.2	68.7	68.2	67.7	67.2	66.7	66.3	65.8	0
	73.4	72.8	72.3	71.8	71.3	70.8	70.3	69.8	69.3	68.8	68.3	67.8	67.3	66.8	66.4	65.9	5
	73.5	73.0	72.5	72.0	71.5	71.0	70.5	70.0	69.5	69.0	68.5	68.0	67.5	67.0	66.6	66.1	10
	73.7	73.2	72.7	72.2	71.7	71.2	70.7	70.2	69.7	69.3	68.8	68.3	67.8	67.4	66.9	66.4	14
	74.1	73.6	73.1	72.6	72.1	71.6	71.1	70.6	70.1	69.6	69.2	68.7	68.2	67.8	67.3	66.8	18
	74.3	73.8	73.3	72.8	72.3	71.8	71.3	70.8	70.3	69.9	69.4	68.9	68.5	68.0	67.5	67.1	20
	74.5	74.0	73.5	73.0	72.5	72.0	71.5	71.1	70.6	70.1	69.7	69.2	68.7	68.3	67.8	67.4	22
	74.7	74.2	73.7	73.2	72.7	72.3	71.8	71.3	70.9	70.4	69.9	69.5	69.0	68.6	68.1	67.7	24
	74.9	74.4	74.0	73.5	73.0	72.5	72.1	71.6	71.1	70.7	70.2	69.8	69.3	68.9	68.4	68.0	26
	75.2	74.7	74.2	73.8	73.3	72.8	72.4	71.9	71.5	71.0	70.5	70.1	69.7	69.2	68.8	68.3	28
	75.4	75.0	74.5	74.1	73.6	73.1	72.7	72.2	71.8	71.3	70.9	70.5	70.0	69.6	69.1	68.7	30
	75.6	75.1	74.7	74.2	73.8	73.3	72.9	72.4	72.0	71.5	71.1	70.6	70.2	69.8	69.3	68.9	31
	75.7	75.3	74.8	74.4	73.9	73.5	73.0	72.6	72.1	71.7	71.3	70.8	70.4	70.0	69.5	69.1	32
	75.9	75.4	75.0	74.5	74.1	73.6	73.2	72.8	72.3	71.9	71.5	71.0	70.6	70.2	69.7	69.3	33
	76.0	75.6	75.1	74.7	74.3	73.8	73.4	72.9	72.5	72.1	71.7	71.2	70.8	70.4	70.0	69.5	34
	76.2	75.8	75.3	74.9	74.4	74.0	73.6	73.1	72.7	72.3	71.9	71.4	71.0	70.6	70.2	69.8	35
	76.4	75.9	75.5	75.1	74.6	74.2	73.8	73.3	72.9	72.5	72.1	71.6	71.2	70.8	70.4	70.0	36
	76.5	76.1	75.7	75.2	74.8	74.4	74.0	73.5	73.1	72.7	72.3	71.9	71.5	71.0	70.6	70.2	37
	76.7	76.3	75.8	75.4	75.0	74.6	74.2	73.7	73.3	72.9	72.5	72.1	71.7	71.3	70.9	70.5	38
	76.9	76.5	76.0	75.6	75.2	74.8	74.4	74.0	73.5	73.1	72.7	72.3	71.9	71.5	71.1	70.7	39
	77.1	76.6	76.2	75.8	75.4	75.0	74.6	74.2	73.8	73.4	73.0	72.6	72.2	71.8	71.4	71.0	40
	77.2	76.8	76.4	76.0	75.6	75.2	74.8	74.4	74.0	73.6	73.2	72.8	72.4	72.0	71.6	71.2	41
	77.4	77.0	76.6	76.2	75.8	75.4	75.0	74.6	74.2	73.8	73.4	73.1	72.7	72.3	71.9	71.5	42
	77.6	77.2	76.8	76.4	76.0	75.6	75.2	74.9	74.5	74.1	73.7	73.3	72.9	72.5	72.2	71.8	43
	77.8	77.4	77.0	76.6	76.3	75.9	75.5	75.1	74.7	74.3	73.9	73.6	73.2	72.8	72.4	72.1	44
	78.0	77.6	77.3	76.9	76.5	76.1	75.7	75.3	75.0	74.6	74.2	73.8	73.5	73.1	72.7	72.3	45
	78.2	77.8	77.5	77.1	76.7	76.3	76.0	75.6	75.2	74.8	74.5	74.1	73.7	73.4	73.0	72.6	46
	78.4	78.1	77.7	77.3	76.9	76.6	76.2	75.8	75.5	75.1	74.7	74.4	74.0	73.7	73.3	72.9	47
	78.6	78.3	77.9	77.5	77.2	76.8	76.5	76.1	75.7	75.4	75.0	74.7	74.3	73.9	73.6	73.2	48
	78.9	78.5	78.1	77.8	77.4	77.1	76.7	76.4	76.0	75.6	75.3	74.9	74.6	74.2	73.9	73.6	49
	79.1	78.7	78.4	78.0	77.7	77.3	77.0	76.6	76.3	75.9	75.6	75.2	74.9	74.5	74.2	73.9	50
	79.3	79.0	78.6	78.3	77.9	77.6	77.2	76.9	76.6	76.2	75.9	75.5	75.2	74.9	74.5	74.2	51
	79.5	79.2	78.9	78.5	78.2	77.8	77.5	77.2	76.8	76.5	76.2	75.8	75.5	75.2	74.8	74.5	52
	79.8	79.4	79.1	78.8	78.4	78.1	77.8	77.4	77.1	76.8	76.5	76.1	75.8	75.5	75.2	74.8	53
	80.0	79.7	79.3	79.0	78.7	78.4	78.1	77.7	77.4	77.1	76.8	76.5	76.1	75.8	75.5	75.2	54
	80.2	79.9	79.6	79.3	79.0	78.6	78.3	78.0	77.7	77.4	77.1	76.8	76.5	76.1	75.8	75.5	55
	80.5	80.2	79.9	79.5	79.2	78.9	78.6	78.3	78.0	77.7	77.4	77.1	76.8	76.5	76.2	75.9	56
	80.7	80.4	80.1	79.8	79.5	79.2	78.9	78.6	78.3	78.0	77.7	77.4	77.1	76.8	76.5	76.2	57
	81.0	80.7	80.4	80.1	79.8	79.5	79.2	78.9	78.6	78.3	78.0	77.7	77.5	77.2	76.9	76.6	58
	81.2	80.9	80.6	80.4	80.1	79.8	79.5	79.2	78.9	78.6	78.4	78.1	77.8	77.5	77.2	77.0	59
	81.5	81.2	80.9	80.6	80.4	80.1	79.8	79.5	79.2	79.0	78.7	78.4	78.1	77.9	77.6	77.3	60
	81.7	81.5	81.2	80.9	80.6	80.4	80.1	79.8	79.6	79.3	79.0	78.8	78.5	78.2	78.0	77.7	61
	82.0	81.7	81.5	81.2	80.9	80.7	80.4	80.1	79.9	79.6	79.4	79.1	78.8	78.6	78.3	78.1	62
	82.2	82.0	81.7	81.5	81.2	81.0	80.7	80.5	80.2	80.0	79.7	79.5	79.2	79.0	78.7	78.5	63
	82.5	82.3	82.0	81.8	81.5	81.3	81.0	80.8	80.5	80.3	80.1	79.8	79.6	79.3	79.1	78.8	64
	82.8	82.5	82.3	82.1	81.8	81.6	81.3	81.1	80.9	80.6	80.4	80.2	79.9	79.7	79.5	79.2	65
	83.0	82.8	82.6	82.4	82.1	81.9	81.7	81.4	81.2	81.0	80.8	80.5	80.3	80.1	79.9	79.6	66
	83.3	83.1	82.9	82.7	82.4	82.2	82.0	81.8	81.6	81.3	81.1	80.9	80.7	80.5	80.2	80.0	67
	83.6	83.4	83.2	83.0	82.7	82.5	82.3	82.1	81.9	81.7	81.5	81.3	81.1	80.8	80.6	80.4	68
Lat																	Lat
A ± B = -30' -31' -32' -33' -34' -35'						36'	37'	38'	39'	40'	41'	42'	43'	44'	45'	A ± B	

A & B Same Names } RULE TO FIND { A & B Different names
take S um, (add). } C CORRECTION { take D ifference (Sub.)
C CORRECTION, (A \pm B) is named the same as the greater of these quantities.
AZIMUTH takes combined names of C Correction and Hour Angle

TABLE C

A ± B =		-45'		-46'	-47'	-48'	-49'	-50'	A & B CORRECTION.				-55'	-56'	-57'	-58'	-59'	60' = A ± B	A ± B		
		-45'		-46'	-47'	-48'	-49'	-50'	-51'	-52'	-53'	-54'	-55'	-56'	-57'	-58'	-59'	60'			
		AZIMUTHS																			
0	65.8	65.3	64.8	64.4	63.9	63.4	63.0	62.5	62.1	61.6	61.2	60.8	60.3	59.9	59.5	59.0	0				
5	65.9	65.4	64.9	64.4	64.0	63.5	63.1	62.6	62.2	61.7	61.3	60.8	60.4	60.0	59.6	59.1	5				
10	66.1	65.6	65.2	64.7	64.2	63.8	63.3	62.9	62.4	62.0	61.6	61.1	60.7	60.3	59.8	59.4	10				
14	66.4	65.9	65.5	65.0	64.6	64.1	63.7	63.2	62.8	62.3	61.9	61.5	61.1	60.6	60.2	59.8	14				
18	66.8	66.4	65.9	65.5	65.0	64.6	64.1	63.7	63.2	62.8	62.4	62.0	61.5	61.1	60.7	60.3	18				
20	67.1	66.6	66.2	65.7	65.3	64.8	64.4	64.0	63.5	63.1	62.7	62.2	61.8	61.4	61.0	60.6	20				
22	67.4	66.9	66.5	66.0	65.6	65.1	64.7	64.3	63.8	63.4	63.0	62.6	62.1	61.7	61.3	60.9	22				
24	67.7	67.2	66.8	66.3	65.9	65.5	65.0	64.6	64.2	63.7	63.3	62.9	62.5	62.1	61.7	61.3	24				
26	68.0	67.5	67.1	66.7	66.2	65.8	65.4	64.9	64.5	64.1	63.7	63.3	62.9	62.5	62.1	61.7	26				
28	68.3	67.9	67.5	67.0	66.6	66.2	65.8	65.3	64.9	64.5	64.1	63.7	63.3	62.9	62.5	62.1	28				
30	68.7	68.3	67.9	67.4	67.0	66.6	66.2	65.8	65.3	64.9	64.5	64.1	63.7	63.3	62.9	62.5	30				
31	68.9	68.5	68.1	67.6	67.2	66.8	66.4	66.0	65.6	65.2	64.8	64.4	64.0	63.6	63.2	62.8	31				
32	69.1	68.7	68.3	67.9	67.4	67.0	66.6	66.2	65.8	65.4	65.0	64.6	64.2	63.8	63.4	63.0	32				
33	69.3	68.9	68.5	68.1	67.7	67.2	66.8	66.4	66.0	65.6	65.2	64.8	64.4	64.0	63.6	63.2	33				
34	69.5	69.1	68.7	68.3	67.9	67.5	67.1	66.7	66.3	65.9	65.5	65.1	64.7	64.3	63.9	63.5	34				
35	69.8	69.4	68.9	68.5	68.1	67.7	67.3	66.9	66.5	66.1	65.7	65.4	65.0	64.6	64.2	63.8	35				
36	70.0	69.6	69.2	68.8	68.4	68.0	67.6	67.2	66.8	66.4	66.0	65.6	65.2	64.9	64.5	64.1	36				
37	70.2	69.8	69.4	69.0	68.6	68.2	67.8	67.4	67.1	66.7	66.3	65.9	65.5	65.1	64.8	64.4	37				
38	70.5	70.1	69.7	69.3	68.9	68.5	68.1	67.7	67.3	66.9	66.6	66.2	65.8	65.4	65.1	64.7	38				
39	70.7	70.3	69.9	69.5	69.2	68.8	68.4	68.0	67.6	67.2	66.9	66.5	66.1	65.7	65.4	65.0	39				
40	71.0	70.6	70.2	69.8	69.4	69.0	68.7	68.3	67.9	67.5	67.2	66.8	66.4	66.0	65.7	65.3	40				
41	71.2	70.9	70.5	70.1	69.7	69.3	68.9	68.6	68.2	67.8	67.5	67.1	66.7	66.4	66.0	65.6	41				
42	71.5	71.1	70.7	70.4	70.0	69.6	69.2	68.9	68.5	68.1	67.8	67.4	67.0	66.7	66.3	66.0	42				
43	71.8	71.4	71.0	70.7	70.3	69.9	69.5	69.2	68.8	68.4	68.1	67.7	67.4	67.0	66.7	66.3	43				
44	72.1	71.7	71.3	71.0	70.6	70.2	69.9	69.5	69.1	68.8	68.4	68.1	67.7	67.4	67.0	66.7	44				
45	72.3	72.0	71.6	71.3	70.9	70.5	70.2	69.8	69.5	69.1	68.7	68.4	68.0	67.7	67.4	67.0	45				
46	72.6	72.3	71.9	71.6	71.2	70.8	70.5	70.1	69.8	69.4	69.1	68.7	68.4	68.1	67.7	67.4	46				
47	72.9	72.6	72.2	71.9	71.5	71.2	70.8	70.5	70.1	69.8	69.4	69.1	68.8	68.4	68.1	67.7	47				
48	73.2	72.9	72.5	72.2	71.8	71.5	71.2	70.8	70.5	70.1	69.8	69.5	69.1	68.8	68.5	68.1	48				
49	73.6	73.2	72.9	72.5	72.2	71.8	71.5	71.2	70.8	70.5	70.2	69.8	69.5	69.2	68.8	68.5	49				
50	73.9	73.5	73.2	72.9	72.5	72.2	71.8	71.5	71.2	70.9	70.5	70.2	69.9	69.6	69.2	68.9	50				
51	74.2	73.9	73.5	73.2	72.9	72.5	72.2	71.9	71.6	71.2	70.9	70.6	70.3	69.9	69.6	69.3	51				
52	74.5	74.2	73.9	73.5	73.2	72.9	72.6	72.2	71.9	71.6	71.3	71.0	70.7	70.3	70.0	69.7	52				
53	74.8	74.5	74.2	73.9	73.6	73.3	72.9	72.6	72.3	72.0	71.7	71.4	71.1	70.8	70.5	70.1	53				
54	75.2	74.9	74.6	74.2	73.9	73.6	73.3	73.0	72.7	72.4	72.1	71.8	71.5	71.2	70.9	70.6	54				
55	75.5	75.2	74.9	74.6	74.3	74.0	73.7	73.4	73.1	72.8	72.5	72.2	71.9	71.6	71.3	71.0	55				
56	75.9	75.6	75.3	75.0	74.7	74.4	74.1	73.8	73.5	73.2	72.9	72.6	72.3	72.0	71.7	71.5	56				
57	76.2	75.9	75.6	75.3	75.1	74.8	74.5	74.2	73.9	73.6	73.3	73.0	72.8	72.5	72.2	71.9	57				
58	76.6	76.3	76.0	75.7	75.4	75.2	74.9	74.6	74.3	74.0	73.8	73.5	73.2	72.9	72.6	72.4	58				
59	77.0	76.7	76.4	76.1	75.8	75.6	75.3	75.0	74.7	74.5	74.2	73.9	73.6	73.4	73.1	72.8	59				
60	77.3	77.0	76.8	76.5	76.2	76.0	75.7	75.4	75.2	74.9	74.6	74.4	74.1	73.8	73.6	73.3	60				
61	77.7	77.4	77.2	76.9	76.6	76.4	76.1	75.9	75.6	75.3	75.1	74.8	74.6	74.3	74.0	73.8	61				
62	78.1	77.8	77.6	77.3	77.0	76.8	76.5	76.3	76.0	75.8	75.5	75.3	75.0	74.8	74.5	74.3	62				
63	78.5	78.2	78.0	77.7	77.5	77.2	77.0	76.7	76.5	76.2	76.0	75.7	75.5	75.2	75.0	74.8	63				
64	78.8	78.6	78.4	78.1	77.9	77.6	77.4	77.2	76.9	76.7	76.4	76.2	76.0	75.7	75.5	75.3	64				
65	79.2	79.0	78.8	78.5	78.3	78.1	77.8	77.6	77.4	77.1	76.9	76.7	76.5	76.2	76.0	75.8	65				
66	79.6	79.4	79.2	79.0	78.7	78.5	78.3	78.1	77.8	77.6	77.4	77.2	76.9	76.7	76.5	76.3	66				
67	80.0	79.8	79.6	79.4	79.2	78.9	78.7	78.5	78.3	78.1	77.9	77.7	77.4	77.2	77.0	76.8	67				
68	80.4	80.2	80.0	79.8	79.6	79.4	79.2	79.0	78.8	78.6	78.4	78.2	77.9	77.7	77.5	77.3	68				
Lat																			Lat		
A ± B =		-45'		-46'	-47'	-48'	-49'	-50'	-51'	-52'	-53'	-54'	-55'	-56'	-57'	-58'	-59'	60' = A ± B			

$A \pm B =$ -45' -46' -47' -48' -49' -50' -51' -52' -53' -54' -55' -56' -57' -58' -59' 60' = $A \pm B$

A & B Same Names } RULE TO FIND { A & B Different names
 take Sum, (add) } C CORRECTION { take Difference (Sub.)

C CORRECTION, ($A \pm B$) is named the same as the greater of these quantities.

AZIMUTH takes combined names of C Correction and Hour Angle

TABLE C

TABLE C																		
A ± B = -60' -62' -64' -66' -68' -70'						A & B CORRECTION												
						-72' -74'		-76' -78'		-80' -82'		-84' -86'		-88' -90' = A ± B				
AZIMUTHS																		
0	59 0	58 2	57 4	56 6	55 8	55 0	54 2	53 5	52 8	52 0	51 3	50 6	50 0	49 3	48 7	48 0	0	
5	59 1	58 3	57 5	56 7	55 9	55 1	54 3	53 6	52 9	52 2	51 5	50 8	50 1	49 4	48 8	48 1	5	
10	59 4	58 6	57 8	57 0	56 2	55 4	54 7	53 9	53 2	52 5	51 8	51 1	50 4	49 7	49 1	48 4	10	
14	59 8	59 0	58 2	57 4	56 6	55 8	55 1	54 3	53 6	52 9	52 2	51 5	50 8	50 2	49 5	48 9	14	
18	60 3	59 5	58 7	57 9	57 1	56 3	55 6	54 9	54 1	53 4	52 7	52 1	51 4	50 7	50 1	49 4	18	
20	60 6	59 8	59 0	58 2	57 4	56 7	55 9	55 2	54 5	53 8	53 1	52 4	51 7	51 1	50 4	49 8	20	
22	60 9	60 1	59 3	58 5	57 8	57 0	56 3	55 5	54 8	54 1	53 4	52 8	52 1	51 4	50 8	50 2	22	
24	61 3	60 5	59 7	58 9	58 2	57 4	56 7	55 9	55 2	54 5	53 8	53 2	52 5	51 8	51 2	50 6	24	
26	61 7	60 9	60 1	59 3	58 6	57 8	57 1	56 4	55 7	55 0	54 3	53 6	52 9	52 3	51 7	51 0	26	
28	62 1	61 3	60 5	59 8	59 0	58 3	57 6	56 8	56 1	55 4	54 8	54 1	53 4	52 8	52 2	51 5	28	
30	62 5	61 8	61 0	60 2	59 5	58 8	58 1	57 3	56 6	56 0	55 3	54 6	54 0	53 3	52 7	52 1	30	
31	62 8	62 0	61 3	60 5	59 8	59 0	58 3	57 6	56 9	56 2	55 6	54 9	54 2	53 6	53 0	52 4	31	
32	63 0	62 3	61 5	60 8	60 0	59 3	58 6	57 9	57 2	56 5	55 8	55 2	54 5	53 9	53 3	52 7	32	
33	63 3	62 5	61 8	61 0	60 3	59 6	58 9	58 2	57 5	56 8	56 1	55 5	54 8	54 2	53 6	53 0	33	
34	63 6	62 8	62 1	61 3	60 6	59 9	59 2	58 5	57 8	57 1	56 4	55 8	55 1	54 5	53 9	53 3	34	
35	63 8	63 1	62 3	61 6	60 9	60 2	59 5	58 8	58 1	57 4	56 8	56 1	55 5	54 8	54 2	53 6	35	
36	64 1	63 4	62 6	61 9	61 2	60 5	59 8	59 1	58 4	57 7	57 1	56 4	55 8	55 2	54 6	53 9	36	
37	64 4	63 7	62 9	62 2	61 5	60 8	60 1	59 4	58 7	58 1	57 4	56 8	56 1	55 5	54 9	54 3	37	
38	64 7	64 0	63 2	62 5	61 8	61 1	60 4	59 8	59 1	58 4	57 8	57 1	56 5	55 9	55 3	54 7	38	
39	65 0	64 3	63 6	62 8	62 1	61 5	60 8	60 1	59 4	58 8	58 1	57 5	56 9	56 2	55 6	55 0	39	
40	65 3	64 6	63 9	63 2	62 5	61 8	61 1	60 5	59 8	59 1	58 5	57 9	57 2	56 6	56 0	55 4	40	
41	65 6	64 9	64 2	63 5	62 8	62 2	61 5	60 8	60 2	59 5	58 9	58 2	57 6	57 0	56 4	55 8	41	
42	66 0	65 3	64 6	63 9	63 2	62 5	61 9	61 2	60 5	59 9	59 3	58 6	58 0	57 4	56 8	56 2	42	
43	66 3	65 6	64 9	64 2	63 6	62 9	62 2	61 6	60 9	60 3	59 7	59 0	58 4	57 8	57 2	56 6	43	
44	66 7	66 0	65 3	64 6	63 9	63 3	62 6	62 0	61 3	60 7	60 1	59 5	58 9	58 3	57 7	57 1	44	
45	67 0	66 3	65 7	65 0	64 3	63 7	63 0	62 4	61 7	61 1	60 5	59 9	59 3	58 7	58 1	57 6	45	
46	67 4	66 7	66 0	65 4	64 7	64 1	63 4	62 8	62 2	61 5	60 9	60 3	59 7	59 1	58 6	58 0	46	
47	67 7	67 1	66 4	65 8	65 1	64 5	63 8	63 2	62 6	62 0	61 4	60 8	60 2	59 6	59 0	58 5	47	
48	68 1	67 5	66 8	66 2	65 5	64 9	64 3	63 7	63 0	62 4	61 8	61 2	60 7	60 1	59 5	58 9	48	
49	68 5	67 9	67 2	66 6	66 0	65 3	64 7	64 1	63 5	62 9	62 3	61 7	61 1	60 6	60 0	59 4	49	
50	68 9	68 3	67 6	67 0	66 4	65 8	65 2	64 6	64 0	63 4	62 8	62 2	61 6	61 1	60 5	60 0	50	
51	69 3	68 7	68 1	67 4	66 8	66 2	65 6	65 0	64 4	63 9	63 3	62 7	62 1	61 6	61 0	60 5	51	
52	69 7	69 1	68 5	67 9	67 3	66 7	66 1	65 5	64 9	64 4	63 8	63 2	62 7	62 1	61 6	61 0	52	
53	70 1	69 5	68 9	68 3	67 7	67 2	66 6	66 0	65 4	64 9	64 3	63 7	63 2	62 6	62 1	61 6	53	
54	70 6	70 0	69 4	68 8	68 2	67 6	67 1	66 5	65 9	65 4	64 8	64 3	63 7	63 2	62 6	62 1	54	
55	71 0	70 4	69 8	69 3	68 7	68 1	67 6	67 0	66 4	65 9	65 4	64 8	64 3	63 7	63 2	62 7	55	
56	71 5	70 9	70 3	69 7	69 2	68 6	68 1	67 5	67 0	66 4	65 9	65 4	64 9	64 3	63 8	63 3	56	
57	71 9	71 3	70 8	70 2	69 7	69 1	68 6	68 0	67 5	67 0	66 5	65 9	65 4	64 9	64 4	63 9	57	
58	72 4	71 8	71 3	70 7	70 2	69 6	69 1	68 6	68 1	67 5	67 0	66 5	66 0	65 5	65 0	64 5	58	
59	72 8	72 3	71 8	71 2	70 7	70 2	69 7	69 1	68 6	68 1	67 6	67 1	66 6	66 1	65 6	65 1	59	
60	73 3	72 8	72 3	71 7	71 2	70 7	70 2	69 7	69 2	68 7	68 2	67 7	67 2	66 7	66 3	65 8	60	
61	73 8	73 3	72 8	72 3	71 8	71 3	70 8	70 3	69 8	69 3	68 8	68 3	67 8	67 4	66 9	66 4	61	
62	74 3	73 8	73 3	72 8	72 3	71 8	71 3	70 8	70 4	69 9	69 4	68 9	68 5	68 0	67 6	67 1	62	
63	74 8	74 3	73 8	73 3	72 8	72 4	71 9	71 4	71 0	70 5	70 0	69 6	69 1	68 7	68 2	67 8	63	
64	75 3	74 8	74 3	73 9	73 4	72 9	72 5	72 0	71 6	71 1	70 7	70 2	69 8	69 3	68 9	68 5	64	
65	75 8	75 3	74 9	74 4	74 0	73 5	73 1	72 6	72 2	71 8	71 3	70 9	70 5	70 0	69 6	69 2	65	
66	76 3	75 8	75 4	75 0	74 5	74 1	73 7	73 2	72 8	72 4	72 0	71 6	71 1	70 7	70 3	69 9	66	
67	76 8	76 4	76 0	75 5	75 1	74 7	74 3	73 9	73 5	73 1	72 6	72 2	71 8	71 4	71 0	70 6	67	
68	77 3	76 9	76 5	76 1	75 7	75 3	74 9	74 5	74 1	73 7	73 3	72 9	72 5	72 1	71 8	71 4	68	
A ± B = -60' -62' -64' -66' -68' -70'						-72' -74'		-76' -78'		-80' -82'		-84' -86'		-88' -90' = A ± B				

A ± B = -60' -62' -64' -66' -68' -70' -72' -74' -76' -78' -80' -82' -84' -86' -88' 90' = A ± B

A & B Same Names } RULE TO FIND { A & B Different names
 take Sum, (add) } C CORRECTION { take Difference (Sub.)
 C CORRECTION, (A ± B) is named the same as the greater of these quantities.
 AZIMUTH takes combined names of C Correction and Hour Angle

TABLE C

A ± B = -90' -92'		-94' -96'		-98' 1 00'		A & B CORRECTION.				1 10' 1 12'		1 14' 1 16'		1 18' 1 20' = A ± B			
						1 02' 1 04'		1 06' 1 08'									
AZIMUTHS																	
0	48 0	47 4	46 8	46 2	45 6	45 0	44 4	43 9	43 3	42 8	42 3	41 8	41 3	40 8	40 3	39 8	0
5	48 1	47 5	46 9	46 3	45 7	45 1	44 5	44 0	43 4	42 9	42 4	41 9	41 4	40 9	40 4	39 9	5
10	48 4	47 8	47 2	46 6	46 0	45 4	44 9	44 3	43 8	43 2	42 7	42 2	41 7	41 2	40 7	40 2	10
14	48 9	48 3	47 7	47 1	46 5	45 9	45 3	44 7	44 2	43 7	43 1	42 6	42 1	41 6	41 2	40 7	14
18	49 4	48 8	48 2	47 6	47 0	46 4	45 9	45 3	44 8	44 2	43 7	43 2	42 7	42 2	41 7	41 2	18
20	49 8	49 2	48 5	47 9	47 4	46 8	46 2	45 7	45 1	44 6	44 1	43 5	43 0	42 5	42 0	41 6	20
22	50 2	49 5	48 9	48 3	47 7	47 2	46 6	46 0	45 5	45 0	44 4	43 9	43 4	42 9	42 4	41 9	22
24	50 6	50 0	49 3	48 7	48 2	47 6	47 0	46 5	45 9	45 4	44 9	44 3	43 8	43 3	42 9	42 4	24
26	51 0	50 4	49 8	49 2	48 6	48 1	47 5	46 9	46 4	45 9	45 3	44 8	44 3	43 8	43 3	42 8	26
28	51 5	50 9	50 3	49 7	49 1	48 6	48 0	47 4	46 9	46 4	45 8	45 3	44 8	44 3	43 8	43 3	28
30	52 1	51 5	50 9	50 3	49 7	49 1	48 5	48 0	47 4	46 9	46 4	45 9	45 4	44 9	44 4	43 9	30
31	52 4	51 7	51 1	50 6	50 0	49 4	48 8	48 3	47 7	47 2	46 7	46 2	45 7	45 2	44 7	44 2	31
32	52 7	52 0	51 4	50 9	50 3	49 7	49 1	48 6	48 0	47 5	47 0	46 5	46 0	45 5	45 0	44 5	32
33	53 0	52 3	51 7	51 2	50 6	50 0	49 5	48 9	48 4	47 8	47 3	46 8	46 3	45 8	45 3	44 8	33
34	53 3	52 7	52 1	51 5	50 9	50 3	49 8	49 2	48 7	48 2	47 6	47 1	46 6	46 1	45 6	45 1	34
35	53 6	53 0	52 4	51 8	51 2	50 7	50 1	49 6	49 0	48 5	48 0	47 5	47 0	46 5	46 0	45 5	35
36	53 9	53 3	52 7	52 2	51 6	51 0	50 5	49 9	49 4	48 9	48 3	47 8	47 3	46 8	46 3	45 8	36
37	54 3	53 7	53 1	52 5	52 0	51 4	50 8	50 3	49 8	49 2	48 7	48 2	47 7	47 2	46 7	46 2	37
38	54 7	54 1	53 5	52 9	52 3	51 8	51 2	50 7	50 1	49 6	49 1	48 6	48 1	47 6	47 1	46 6	38
39	55 0	54 4	53 9	53 3	52 7	52 1	51 6	51 1	50 5	50 0	49 5	49 0	48 5	48 0	47 5	47 0	39
40	55 4	54 8	54 2	53 7	53 1	52 5	52 0	51 5	50 9	50 4	49 9	49 4	48 9	48 4	47 9	47 4	40
41	55 8	55 2	54 6	54 1	53 5	53 0	52 4	51 9	51 3	50 8	50 3	49 8	49 3	48 8	48 3	47 8	41
42	56 2	55 6	55 1	54 5	53 9	53 4	52 8	52 3	51 8	51 2	50 7	50 2	49 7	49 2	48 8	48 3	42
43	56 6	56 1	55 5	54 9	54 4	53 8	53 3	52 7	52 2	51 7	51 2	50 7	50 2	49 7	49 2	48 7	43
44	57 1	56 5	55 9	55 4	54 8	54 3	53 7	53 2	52 7	52 2	51 6	51 1	50 6	50 2	49 7	49 2	44
45	57 5	57 0	56 4	55 8	55 3	54 7	54 2	53 7	53 1	52 6	52 1	51 6	51 1	50 6	50 2	49 7	45
46	58 0	57 4	56 9	56 3	55 8	55 2	54 7	54 2	53 6	53 1	52 6	52 1	51 6	51 1	50 7	50 2	46
47	58 5	57 9	57 3	56 8	56 2	55 7	55 2	54 7	54 1	53 6	53 1	52 6	52 1	51 7	51 2	50 7	47
48	58 9	58 4	57 8	57 3	56 7	56 2	55 7	55 2	54 7	54 1	53 6	53 2	52 7	52 2	51 7	51 2	48
49	59 4	58 9	58 3	57 8	57 3	56 7	56 2	55 7	55 2	54 7	54 2	53 7	53 2	52 7	52 3	51 8	49
50	60 0	59 4	58 9	58 3	57 8	57 3	56 7	56 2	55 7	55 2	54 7	54 2	53 8	53 3	52 8	52 4	50
51	60 5	59 9	59 4	58 9	58 3	57 8	57 3	56 8	56 3	55 8	55 3	54 8	54 3	53 9	53 4	52 9	51
52	61 0	60 5	59 9	59 4	58 9	58 4	57 9	57 4	56 9	56 4	55 9	55 4	54 9	54 5	54 0	53 5	52
53	61 6	61 0	60 5	60 0	59 5	59 0	58 5	58 0	57 5	57 0	56 5	56 0	55 5	55 1	54 6	54 2	53
54	62 1	61 6	61 1	60 6	60 1	59 6	59 1	58 6	58 1	57 6	57 1	56 6	56 2	55 7	55 3	54 8	54
55	62 7	62 2	61 7	61 2	60 7	60 2	59 7	59 2	58 7	58 2	57 8	57 3	56 8	56 4	55 9	55 5	55
56	63 3	62 8	62 3	61 8	61 3	60 8	60 3	59 8	59 3	58 9	58 4	57 9	57 5	57 0	56 6	56 1	56
57	63 9	63 4	62 9	62 4	61 9	61 4	60 9	60 5	60 0	59 5	59 1	58 6	58 2	57 7	57 3	56 8	57
58	64 5	64 0	63 5	63 0	62 6	62 1	61 6	61 1	60 7	60 2	59 8	59 3	58 9	58 4	58 0	57 5	58
59	65 1	64 6	64 2	63 7	63 2	62 7	62 3	61 8	61 4	60 9	60 5	60 0	59 6	59 1	58 7	58 3	59
60	65 8	65 3	64 8	64 4	63 9	63 4	63 0	62 5	62 1	61 6	61 2	60 8	60 3	59 9	59 5	59 0	60
61	66 4	66 0	65 5	65 0	64 6	64 1	63 7	63 2	62 8	62 4	61 9	61 5	61 1	60 6	60 2	59 8	61
62	67 1	66 6	66 2	65 7	65 3	64 9	64 4	64 0	63 5	63 1	62 7	62 3	61 8	61 4	61 0	60 6	62
63	67 8	67 3	66 9	66 5	66 0	65 6	65 2	64 7	64 3	63 9	63 5	63 0	62 6	62 2	61 8	61 4	63
64	68 5	68 0	67 6	67 2	66 8	66 3	65 9	65 5	65 1	64 7	64 3	63 9	63 4	63 0	62 6	62 3	64
65	69 2	68 8	68 3	67 9	67 5	67 1	66 7	66 3	65 9	65 5	65 1	64 7	64 3	63 9	63 5	63 1	65
66	69 9	69 5	69 1	68 7	68 3	67 9	67 5	67 1	66 7	66 3	65 9	65 5	65 1	64 7	64 4	64 0	66
67	70 6	70 2	69 8	69 4	69 0	68 7	68 3	67 9	67 5	67 1	66 7	66 4	66 0	65 6	65 2	64 9	67
68	71 4	71 0	70 6	70 2	69 8	69 5	69 1	68 7	68 3	68 0	67 6	67 2	66 9	66 5	66 2	65 8	68
AZIMUTHS																	
A ± B = -90' -92'		-94' -96'		-98' 1 00'		1 02' 1 04'		1 06' 1 08'		1 10' 1 12'		1 14' 1 16'		1 18' 1 20' = A ± B			

A & B Same Names } RULE TO FIND { A & B Different names
 take Sum. (add.) } C CORRECTION { take Difference (Sub.)
 C CORRECTION, (A ± B) is named the same as the greater of these quantities.
 AZIMUTH takes combined names of C Correction and Hour Angle

TABLE C																																			
A ± B = 1 20' 1 24'				1 28' 1 32'				1 36' 1 40'				A & B CORRECTION.				1 44' 1 48'				1 52' 1 56'				1 60' 1 64'				1 68' 1 72'				1 76' 1 80' = A ± B			
AZIMUTHS																																			
0	39.8	38.9	38.0	37.1	36.3	35.5	34.8	34.0	33.3	32.7	32.0	31.4	30.8	30.2	29.6	29.1	0																		
5	39.9	39.0	38.1	37.3	36.4	35.6	34.9	34.1	33.4	32.8	32.1	31.5	30.9	30.3	29.7	29.2	5																		
10	40.2	39.3	38.4	37.6	36.8	36.0	35.2	34.5	33.8	33.1	32.4	31.8	31.2	30.6	30.0	29.4	10																		
14	40.7	39.7	38.8	38.0	37.2	36.4	35.6	34.9	34.2	33.5	32.8	32.1	31.5	30.9	30.4	29.8	14																		
18	41.2	40.3	39.4	38.5	37.7	36.9	36.1	35.4	34.7	34.0	33.3	32.7	32.0	31.4	30.9	30.3	18																		
20	41.6	40.6	39.7	38.9	38.0	37.2	36.5	35.7	35.0	34.3	33.6	33.0	32.4	31.8	31.2	30.6	20																		
22	42.0	41.0	40.1	39.3	38.4	37.6	36.8	36.1	35.4	34.7	34.0	33.3	32.7	32.1	31.5	30.9	22																		
24	42.4	41.4	40.5	39.7	38.8	38.0	37.2	36.5	35.8	35.1	34.4	33.7	33.1	32.5	31.9	31.3	24																		
26	42.8	41.9	41.0	40.1	39.3	38.5	37.7	36.9	36.2	35.5	34.8	34.2	33.5	32.9	32.3	31.7	26																		
28	43.3	42.4	41.5	40.6	39.8	39.0	38.2	37.4	36.7	36.0	35.3	34.6	34.0	33.4	32.8	32.2	28																		
30	43.9	43.0	42.1	41.2	40.3	39.5	38.7	38.0	37.2	36.5	35.8	35.1	34.5	33.9	33.3	32.7	30																		
31	44.2	43.3	42.4	41.5	40.6	39.8	39.0	38.2	37.5	36.8	36.1	35.4	34.8	34.1	33.5	32.9	31																		
32	44.5	43.6	42.7	41.8	40.9	40.1	39.3	38.5	37.8	37.1	36.4	35.7	35.1	34.4	33.8	33.2	32																		
33	44.8	43.9	43.0	42.1	41.2	40.4	39.6	38.9	38.1	37.4	36.7	36.0	35.4	34.7	34.1	33.5	33																		
34	45.1	44.2	43.3	42.4	41.6	40.7	39.9	39.2	38.4	37.7	37.0	36.3	35.7	35.0	34.4	33.8	34																		
35	45.5	44.6	43.7	42.8	41.9	41.1	40.3	39.5	38.8	38.0	37.3	36.7	36.0	35.4	34.7	34.1	35																		
36	45.8	44.9	44.0	43.1	42.3	41.4	40.6	39.9	39.1	38.4	37.7	37.0	36.3	35.7	35.1	34.5	36																		
37	46.2	45.3	44.4	43.5	42.6	41.8	41.0	40.2	39.5	38.8	38.1	37.4	36.7	36.1	35.4	34.8	37																		
38	46.6	45.7	44.8	43.9	43.0	42.2	41.4	40.6	39.9	39.1	38.4	37.7	37.1	36.4	35.8	35.2	38																		
39	47.0	46.1	45.2	44.3	43.4	42.6	41.8	41.0	40.3	39.5	38.8	38.1	37.4	36.8	36.2	35.6	39																		
40	47.4	46.5	45.6	44.7	43.8	43.0	42.2	41.4	40.7	39.9	39.2	38.5	37.8	37.2	36.6	36.0	40																		
41	47.8	46.9	46.0	45.1	44.3	43.4	42.6	41.8	41.1	40.3	39.6	33.9	38.3	37.6	37.0	36.4	41																		
42	48.3	47.3	46.4	45.6	44.7	43.9	43.1	42.3	41.5	40.8	40.1	39.4	38.7	38.0	37.4	36.8	42																		
43	48.7	47.8	46.9	46.0	45.2	44.3	43.5	42.7	42.0	41.2	40.5	39.8	39.1	38.5	37.8	37.2	43																		
44	49.2	48.3	47.4	46.5	45.6	44.8	44.0	43.2	42.4	41.7	41.0	40.3	39.6	38.9	38.3	37.7	44																		
45	49.7	48.8	47.9	47.0	46.1	45.3	44.5	43.7	42.9	42.2	41.5	40.8	40.1	39.4	38.8	38.2	45																		
46	50.2	49.3	48.4	47.5	46.6	45.8	45.0	44.2	43.4	42.7	42.0	41.3	40.6	39.9	39.3	38.7	46																		
47	50.7	49.8	48.9	48.0	47.2	46.3	45.5	44.7	44.0	43.2	42.5	41.8	41.1	40.4	39.8	39.2	47																		
48	51.2	50.3	49.4	48.5	47.7	46.9	46.1	45.3	44.5	43.8	43.0	42.3	41.7	41.0	40.3	39.7	48																		
49	51.8	50.9	50.0	49.1	48.3	47.4	46.6	45.8	45.1	44.3	43.6	42.9	42.2	41.5	40.9	40.3	49																		
50	52.4	51.5	50.6	49.7	48.8	48.0	47.2	46.4	45.7	44.9	44.2	43.5	42.8	42.1	41.5	40.8	50																		
51	52.9	52.0	51.2	50.3	49.4	48.6	47.8	47.0	46.3	45.5	44.8	44.1	43.4	42.7	42.1	41.4	51																		
52	53.5	52.6	51.8	50.9	50.1	49.2	48.4	47.7	46.9	46.2	45.4	44.7	44.0	43.4	42.7	42.1	52																		
53	54.2	53.3	52.4	51.5	50.7	49.9	49.1	48.3	47.5	46.8	46.1	45.4	44.7	44.0	43.4	42.7	53																		
54	54.8	53.9	53.0	52.2	51.4	50.6	49.8	49.0	48.2	47.5	46.8	46.1	45.4	44.7	44.0	43.4	54																		
55	55.5	54.6	53.7	52.9	52.0	51.2	50.5	49.7	48.9	48.2	47.5	46.8	46.1	45.4	44.7	44.1	55																		
56	56.1	55.3	54.4	53.6	52.7	51.9	51.2	50.4	49.6	48.9	48.2	47.5	46.8	46.1	45.5	44.8	56																		
57	56.8	56.0	55.1	54.3	53.5	52.7	51.9	51.1	50.4	49.7	48.9	48.2	47.5	46.9	46.2	45.6	57																		
58	57.5	56.7	55.9	55.0	54.2	53.4	52.7	51.9	51.1	50.4	49.7	49.0	48.3	47.7	47.0	46.4	58																		
59	58.3	57.4	56.6	55.8	55.0	54.2	53.4	52.7	51.9	51.2	50.5	49.8	49.1	48.5	47.8	47.2	59																		
60	59.0	58.2	57.4	56.6	55.8	55.0	54.2	53.5	52.8	52.0	51.3	50.6	50.0	49.3	48.7	48.0	60																		
61	59.8	59.0	58.2	57.4	56.6	55.8	55.1	54.3	53.6	52.9	52.2	51.5	50.8	50.2	49.5	48.9	61																		
62	60.6	59.8	59.0	58.2	57.4	56.7	55.9	55.2	54.5	53.8	53.1	52.4	51.7	51.1	50.4	49.8	62																		
63	61.4	60.6	59.8	59.1	58.3	57.6	56.8	56.1	55.4	54.7	54.0	53.3	52.7	52.0	51.4	50.7	63																		
64	62.3	61.5	60.7	59.9	59.2	58.5	57.7	57.0	56.3	55.6	55.0	54.3	53.6	53.0	52.4	51.7	64																		
65	63.1	62.3	61.6	60.8	60.1	59.4	58.7	58.0	57.3	56.6	55.9	55.3	54.6	54.0	53.4	52.7	65																		
66	64.0	63.2	62.5	61.8	61.1	60.3	59.6	59.0	58.3	57.6	56.9	56.3	55.7	55.0	54.4	53.8	66																		
67	64.9	64.1	63.4	62.7	62.0	61.3	60.6	60.0	59.3	58.6	58.0	57.3	56.7	56.1	55.5	54.9	67																		
68	65.8	65.1	64.4	63.7	63.0	62.3	61.7	61.0	60.3	59.7	59.1	58.4	57.8	57.2	56.6	56.0	68																		
A ± B = 1 20' 1 24' 1 28' 1 32' 1 36' 1 40' 1 44' 1 48' 1 52' 1 56' 1 60' 1 64' 1 68' 1 72' 1 76' 1 80' = A ± B																																			

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 AZIMUTH takes combined names of C Correction and Hour Angle

TABLE C

A ± B = 1° 80' 1 84'		1 88' 1 92'	1 96' 2 00'	A & B CORRECTION.				2 20' 2 24'	2 28' 2 32'	2 36' 2 40' = A ± B	
AZIMUTHS				2 04'	2 08'	2 12'	2 16'				
Lat											Lat
0	29 1 28.5	28 0 27.5	27 0 26.6	26 1 25.7	25 2 24.8	24 4 24.0	23 7 23.3	23 0 22.6	22 3 21.9	21 6 21.2	0
5	29 1 28.6	28 1 27.6	27 1 26.7	26 2 25.8	25 3 24.9	24 5 24.1	23 8 23.4	23 0 22.7	22 3 22.0	21 6 21.3	5
10	29 4 28.9	28 4 27.9	27 4 26.9	26 5 26.0	25 6 25.2	24 8 24.4	24 0 23.6	23 3 22.9	22 6 22.2	21 9 21.6	10
14	29 8 29.3	28 7 28.2	27 7 27.3	26 8 26.4	25 9 25.5	25 1 24.7	24 3 24.0	23 6 23.2	22 9 22.5	22 2 21.9	14
18	30 3 29.7	29 2 28.7	28 2 27.7	27 3 26.8	26 4 26.0	25 6 25.2	24 8 24.4	24 0 23.7	23 3 23.0	22 6 22.3	18
20	30 6 30 0	29 5 29 0	28 5 28 0	27 6 27 1	26 7 26 2	25 8 25 4	25 0 24 6	24 3 23 9	23 6 23 2	22 9 22 5	20
22	30 9 30 4	29 8 29 3	28 8 28 3	27 9 27 4	27 0 26 5	26 1 25 7	25 3 24 9	24 6 24 2	23 9 23 5	23 2 23 0	22
24	31 3 30 8	30 2 29 7	29 2 28 7	28 2 27 8	27 3 26 9	26 5 26 1	25 7 25 3	24 9 24 5	24 2 24 0	23 5 23 2	24
26	31 7 31 2	30 6 30 1	29 6 29 1	28 6 28 2	27 7 27 3	26 8 26 4	26 0 25 6	25 2 24 9	24 5 24 1	23 8 23 4	26
28	32 2 31 6	31 1 30 5	30 0 29 5	29 0 28 6	28 1 27 7	27 2 26 8	26 4 26 0	25 6 25 3	24 9 24 5	24 2 23 8	28
30	32 7 32 1	31 6 31 0	30 5 30 0	29 5 29 0	28 6 28 1	27 7 27 3	26 9 26 5	26 1 25 7	25 4 25 0	24 7 24 3	30
31	32 9 32 4	31 8 31 3	30 8 30 3	29 8 29 3	28 8 28 4	27 9 27 5	27 1 26 7	26 3 25 9	25 6 25 2	24 9 24 5	31
32	33 2 32 7	32 1 31 6	31 0 30 5	30 0 29 6	29 1 28 6	28 2 27 8	27 3 26 9	26 5 26 2	25 8 25 4	25 1 24 7	32
33	33 5 32 9	32 4 31 8	31 3 30 8	30 3 29 8	29 4 28 9	28 5 28 0	27 6 27 2	26 8 26 4	26 1 25 7	25 4 25 0	33
34	33 8 33 2	32 7 32 1	31 6 31 1	30 6 30 1	29 6 29 2	28 7 28 3	27 9 27 5	27 1 26 7	26 4 26 0	25 7 25 3	34
35	34 1 33 6	33 0 32 4	31 9 31 4	30 9 30 4	29 9 29 5	29 0 28 6	28 2 27 8	27 4 27 0	26 7 26 3	26 0 25 6	35
36	34 5 33 9	33 3 32 8	32 2 31 7	31 2 30 7	30 3 29 8	29 3 28 9	28 5 28 1	27 7 27 3	27 0 26 6	26 3 25 9	36
37	34 8 34 2	33 7 33 1	32 6 32 1	31 6 31 1	30 6 30 1	29 6 29 2	28 8 28 4	28 0 27 6	27 3 26 9	26 6 26 2	37
38	35 2 34 6	34 0 33 5	32 9 32 4	31 9 31 4	30 9 30 4	30 0 29 5	29 1 28 7	28 3 27 9	27 6 27 2	26 9 26 5	38
39	35 6 35 0	34 4 33 8	33 3 32 8	32 3 31 8	31 3 30 8	30 3 29 9	29 4 29 0	28 6 28 2	27 9 27 5	27 2 26 8	39
40	36 0 35 4	34 8 34 2	33 7 33 1	32 6 32 1	31 6 31 2	30 7 30 2	29 8 29 4	28 9 28 5	28 2 27 8	27 5 27 1	40
41	36 4 35 8	35 2 34 6	34 1 33 5	33 0 32 5	32 0 31 5	31 1 30 6	30 2 29 7	29 3 28 9	28 6 28 2	27 9 27 5	41
42	36 8 36 2	35 6 35 0	34 5 33 9	33 4 32 9	32 4 31 9	31 5 31 0	30 5 30 1	29 7 29 3	29 0 28 6	28 3 27 9	42
43	37 2 36 6	36 0 35 5	34 9 34 4	33 8 33 3	32 8 32 3	31 9 31 4	31 0 30 5	30 1 29 7	29 4 29 0	28 7 28 3	43
44	37 7 37 1	36 5 35 9	35 3 34 8	34 3 33 8	33 3 32 8	32 3 31 8	31 4 30 9	30 5 30 1	29 8 29 4	29 1 28 7	44
45	38 2 37 6	37 0 36 4	35 8 35 3	34 7 34 2	33 7 33 2	32 7 32 3	31 8 31 4	30 9 30 5	30 2 29 8	29 5 29 1	45
46	38 7 38 1	37 5 36 9	36 3 35 7	35 2 34 7	34 2 33 7	33 2 32 7	32 3 31 8	31 4 31 0	30 7 30 3	30 0 29 6	46
47	39 2 38 6	38 0 37 4	36 8 36 2	35 7 35 2	34 7 34 2	33 7 33 2	32 7 32 3	31 9 31 4	31 2 30 8	30 5 30 1	47
48	39 7 39 1	38 5 37 9	37 3 36 8	36 2 35 7	35 2 34 7	34 2 33 7	33 2 32 8	32 4 31 9	31 7 31 3	31 0 30 6	48
49	40 3 39 6	39 0 38 4	37 9 37 3	36 8 36 2	35 7 35 2	34 7 34 2	33 8 33 3	32 9 32 4	32 2 31 8	31 5 31 1	49
50	40 8 40 2	39 6 39 0	38 4 37 9	37 3 36 8	36 3 35 8	35 3 34 8	34 3 33 8	33 4 33 0	32 7 32 3	32 0 31 6	50
51	41 4 40 8	40 2 39 6	39 0 38 5	37 9 37 4	36 9 36 3	35 8 35 3	34 9 34 4	34 0 33 5	33 3 32 9	32 6 32 2	51
52	42 1 41 4	40 8 40 2	39 6 39 1	38 5 38 0	37 5 36 9	36 4 35 9	35 5 35 0	34 5 34 1	33 8 33 4	33 1 32 7	52
53	42 7 42 1	41 5 40 9	40 3 39 7	39 2 38 6	38 1 37 6	37 1 36 6	36 1 35 6	35 1 34 7	34 4 34 0	33 7 33 3	53
54	43 4 42 8	42 1 41 5	41 0 40 4	39 8 39 3	38 7 38 2	37 7 37 2	36 7 36 3	35 8 35 3	35 1 34 7	34 4 34 0	54
55	44 1 43 5	42 8 42 2	41 7 41 1	40 5 40 0	39 4 38 9	38 4 37 9	37 4 36 9	36 5 36 0	35 8 35 4	35 1 34 7	55
56	44 8 44 2	43 6 43 0	42 4 41 8	41 2 40 7	40 1 39 6	39 1 38 6	38 1 37 6	37 2 36 7	36 5 36 1	35 8 35 4	56
57	45 6 44 9	44 3 43 7	43 1 42 6	42 0 41 4	40 9 40 4	39 8 39 3	38 8 38 4	37 9 37 4	37 2 36 8	36 5 36 1	57
58	46 4 45 7	45 1 44 5	43 9 43 4	42 8 42 2	41 7 41 2	40 6 40 1	39 6 39 1	38 6 38 2	37 9 37 5	37 2 36 8	58
59	47 2 46 5	45 9 45 3	44 7 44 2	43 6 43 0	42 5 42 0	41 4 40 9	40 4 39 9	39 4 39 0	38 7 38 3	38 0 37 6	59
60	48 0 47 4	46 8 46 2	45 6 45 0	44 4 43 9	43 3 42 8	42 3 41 8	41 3 40 8	40 3 39 8	39 6 39 2	38 9 38 5	60
61	48 9 48 3	47 7 47 1	46 5 45 9	45 3 44 8	44 2 43 7	43 2 42 7	42 2 41 7	41 2 40 7	40 5 40 1	39 8 39 4	61
62	49 8 49 2	48 6 48 0	47 4 46 8	46 2 45 7	45 1 44 6	44 1 43 6	43 1 42 6	42 1 41 6	41 4 41 0	40 7 40 3	62
63	50 7 50 1	49 5 48 9	48 3 47 8	47 2 46 6	46 1 45 6	45 0 44 5	44 0 43 5	43 0 42 5	42 3 41 9	41 6 41 2	63
64	51 7 51 1	50 5 49 9	49 3 48 8	48 2 47 6	47 1 46 6	46 0 45 5	45 0 44 5	44 0 43 5	43 3 42 9	42 6 42 2	64
65	52 7 52 1	51 5 50 9	50 4 49 8	49 2 48 7	48 1 47 6	47 1 46 6	46 1 45 6	45 1 44 6	44 4 44 0	43 7 43 3	65
66	53 8 53 2	52 6 52 0	51 4 50 9	50 3 49 8	49 2 48 7	48 2 47 7	47 2 46 7	46 2 45 7	45 5 45 1	44 8 44 4	66
67	54 9 54 3	53 7 53 1	52 6 52 0	51 4 50 9	50 4 49 8	49 3 48 8	48 3 47 8	47 3 46 8	46 6 46 2	45 9 45 5	67
68	56 0 55 4	54 8 54 3	53 7 53 2	52 6 52 1	51 5 51 0	50 5 50 0	49 5 49 0	48 5 48 0	47 8 47 3	47 1 46 6	68
Lat											Lat

A & B Same Names } RULE TO FIND { A & B Different names
 take Sum, (add) } C CORRECTION { take Difference (Sub.)
 C CORRECTION, (A ± B) is named the same as the greater of these quantities.
 AZIMUTH takes combined names of C Correction and Hour Angle

TABLE C

TABLE C																	
A ± B = 2° 40' 2 45'			2 50' 2 55'		2 60' 2 65'		A & B CORRECTION.				3 00' 3 10'		3 20' 3 30'		3 40' 3 50' = A ± B		
							2 70' 2 75'		2 80' 2 90'								
AZIMUTHS																	
Lat.	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	Lat.	
0	22.6	22.2	21.8	21.4	21.0	20.7	20.3	20.0	19.7	19.0	18.4	17.9	17.4	16.9	16.4	15.9	0
5	22.7	22.3	21.9	21.5	21.1	20.8	20.4	20.1	19.7	19.1	18.5	17.9	17.4	16.9	16.4	16.0	5
10	22.9	22.5	22.1	21.7	21.3	21.0	20.6	20.3	19.9	19.3	18.7	18.1	17.6	17.1	16.6	16.2	10
14	23.2	22.8	22.4	22.0	21.6	21.3	20.9	20.5	20.2	19.6	19.0	18.4	17.9	17.4	16.9	16.4	14
18	23.7	23.2	22.8	22.4	22.0	21.6	21.3	20.9	20.6	19.9	19.3	18.7	18.2	17.7	17.2	16.7	18
20	23.9	23.5	23.1	22.7	22.3	21.9	21.5	21.2	20.8	20.2	19.5	18.9	18.4	17.9	17.4	16.9	20
22	24.2	23.8	23.3	22.9	22.5	22.2	21.8	21.4	21.1	20.4	19.8	19.2	18.6	18.1	17.6	17.1	22
24	24.5	24.1	23.6	23.2	22.8	22.5	22.1	21.7	21.4	20.7	20.0	19.4	18.9	18.4	17.8	17.4	24
26	24.9	24.4	24.0	23.6	23.2	22.8	22.4	22.0	21.7	21.0	20.3	19.7	19.2	18.6	18.1	17.6	26
28	25.3	24.8	24.4	23.9	23.5	23.1	22.8	22.4	22.0	21.3	20.7	20.1	19.5	18.9	18.4	17.9	28
30	25.7	25.2	24.8	24.4	23.9	23.5	23.2	22.8	22.4	21.7	21.1	20.4	19.8	19.3	18.8	18.3	30
31	25.9	25.5	25.0	24.6	24.2	23.8	23.4	23.0	22.6	21.9	21.2	20.6	20.0	19.5	18.9	18.4	31
32	26.2	25.7	25.3	24.8	24.4	24.0	23.6	23.2	22.8	22.1	21.5	20.8	20.2	19.7	19.1	18.6	32
33	26.4	26.0	25.5	25.1	24.6	24.2	23.8	23.4	23.1	22.4	21.7	21.0	20.4	19.9	19.3	18.8	33
34	26.7	26.2	25.8	25.3	24.9	24.5	24.1	23.7	23.3	22.6	21.9	21.3	20.7	20.1	19.5	19.0	34
35	27.0	26.5	26.0	25.6	25.2	24.7	24.3	23.9	23.6	22.8	22.1	21.5	20.9	20.3	19.8	19.2	35
36	27.3	26.8	26.3	25.9	25.4	25.0	24.6	24.2	23.8	23.1	22.4	21.7	21.1	20.5	20.0	19.5	36
37	27.6	27.1	26.6	26.2	25.7	25.3	24.9	24.5	24.1	23.4	22.7	22.0	21.4	20.8	20.2	19.7	37
38	27.9	27.4	26.9	26.5	26.0	25.6	25.2	24.8	24.4	23.6	22.9	22.3	21.6	21.0	20.5	19.9	38
39	28.2	27.7	27.2	26.8	26.3	25.9	25.5	25.1	24.7	23.9	23.2	22.5	21.9	21.3	20.7	20.2	39
40	28.5	28.1	27.6	27.1	26.7	26.2	25.8	25.4	25.0	24.2	23.5	22.8	22.2	21.6	21.0	20.5	40
41	28.9	28.4	27.9	27.5	27.0	26.6	26.1	25.7	25.3	24.6	23.8	23.1	22.5	21.9	21.3	20.7	41
42	29.3	28.8	28.3	27.8	27.4	26.9	26.5	26.1	25.7	24.9	24.2	23.5	22.8	22.2	21.6	21.0	42
43	29.7	29.2	28.7	28.2	27.7	27.3	26.9	26.4	26.0	25.2	24.5	23.8	23.1	22.5	21.9	21.3	43
44	30.1	29.6	29.1	28.6	28.1	27.7	27.2	26.8	26.4	25.6	24.9	24.2	23.5	22.8	22.2	21.7	44
45	30.5	30.0	29.5	29.0	28.5	28.1	27.6	27.2	26.8	26.0	25.2	24.5	23.8	23.2	22.6	22.0	45
46	31.0	30.4	29.9	29.5	29.0	28.6	28.1	27.6	27.2	26.4	25.6	24.9	24.2	23.6	22.9	22.4	46
47	31.4	30.9	30.4	29.9	29.4	29.0	28.5	28.1	27.6	26.8	26.0	25.3	24.6	24.0	23.3	22.7	47
48	31.9	31.4	30.9	30.4	29.9	29.4	29.0	28.5	28.1	27.3	26.5	25.7	25.0	24.4	23.7	23.1	48
49	32.4	31.9	31.4	30.9	30.4	29.9	29.4	29.0	28.6	27.7	26.9	26.2	25.5	24.8	24.1	23.5	49
50	33.0	32.4	31.9	31.4	30.9	30.4	30.0	29.5	29.1	28.2	27.4	26.6	25.9	25.2	24.6	24.0	50
51	33.5	33.0	32.4	31.9	31.4	30.9	30.5	30.0	29.6	28.7	27.9	27.1	26.4	25.7	25.0	24.4	51
52	34.1	33.5	33.0	32.5	32.0	31.5	31.0	30.6	30.1	29.3	28.5	27.7	26.9	26.2	25.5	24.9	52
53	34.7	34.1	33.6	33.1	32.6	32.1	31.6	31.1	30.7	29.8	29.0	28.2	27.4	26.7	26.0	25.4	53
54	35.3	34.8	34.2	33.7	33.2	32.7	32.2	31.7	31.3	30.4	29.6	28.8	28.0	27.3	26.6	25.9	54
55	36.0	35.4	34.9	34.4	33.8	33.4	32.9	32.4	31.9	31.0	30.2	29.4	28.6	27.9	27.1	26.5	55
56	36.7	36.1	35.6	35.1	34.5	34.0	33.5	33.1	32.6	31.7	30.8	30.0	29.2	28.5	27.7	27.1	56
57	37.4	36.8	36.3	35.8	35.2	34.7	34.2	33.8	33.3	32.4	31.5	30.6	29.8	29.1	28.4	27.7	57
58	38.2	37.6	37.0	36.5	36.0	35.5	35.0	34.5	34.0	33.1	32.2	31.3	30.5	29.8	29.0	28.3	58
59	39.0	38.4	37.8	37.3	36.8	36.3	35.7	35.2	34.7	33.8	32.9	32.1	31.2	30.5	29.7	29.0	59
60	39.8	39.2	38.7	38.1	37.6	37.1	36.5	36.0	35.5	34.6	33.7	32.8	32.0	31.2	30.5	29.8	60
61	40.7	40.1	39.5	39.0	38.4	37.9	37.4	36.9	36.4	35.4	34.5	33.6	32.8	32.0	31.2	30.5	61
62	41.6	41.0	40.4	39.9	39.3	38.8	38.3	37.8	37.3	36.3	35.4	34.5	33.6	32.8	32.1	31.3	62
63	42.5	42.0	41.4	40.8	40.3	39.7	39.2	38.7	38.2	37.2	36.3	35.4	34.5	33.7	32.9	32.2	63
64	43.5	43.0	42.4	41.8	41.3	40.7	40.2	39.7	39.2	38.2	37.3	36.4	35.5	34.7	33.9	33.1	64
65	44.6	44.0	43.4	42.9	42.3	41.8	41.2	40.7	40.2	39.2	38.3	37.4	36.5	35.7	34.9	34.1	65
66	45.7	45.1	44.5	44.0	43.4	42.9	42.3	41.8	41.3	40.3	39.3	38.4	37.6	36.7	35.9	35.1	66
67	46.8	46.2	45.7	45.1	44.6	44.0	43.5	42.9	42.4	41.4	40.5	39.5	38.7	37.8	37.0	36.2	67
68	48.0	47.4	46.9	46.3	45.8	45.2	44.7	44.1	43.6	42.6	41.7	40.7	39.8	39.0	38.1	37.3	68
Lat.																	Lat.
A ± B = 2° 40' 2 45'			2 50' 2 55'		2 60' 2 65'		2 70' 2 75'		2 80' 2 90'		3 00' 3 10'		3 20' 3 30'		3 40' 3 50' = A ± B		A ± B

A ± B = 2° 40' 2 45' 2 50' 2 55' 2 60' 2 65' 2 70' 2 75' 2 80' 2 90' 3 00' 3 10' 3 20' 3 30' 3 40' 3 50' = A ± B

A & B Same Names } RULE TO FIND { A & B Different names
 take (Sum, add) } C CORRECTION { take (Difference, Sub.)
 C CORRECTION, (A ± B) is named the same as the greater of these quantities.
 AZIMUTH takes combined names of C Correction and Hour Angle

TABLE C

$A \pm B = 3-50' \quad 3-60'$		$3-70' \quad 3-80'$		$3-90' \quad 4-00'$		A & B CORRECTION.				$4-50' \quad 4-60'$		$4-70' \quad 4-80'$		$4-90' \quad 5-00' = A \pm B$	
						AZIMUTHS									
Lat	Long	Lat	Long	Lat	Long	Lat	Long	Lat	Long	Lat	Long	Lat	Long	Lat	Long
0	15-9	15-5	15-1	14-7	14-4	14-0	13-7	13-4	13-1	12-8	12-5	12-3	12-0	11-8	11-5
5	16-0	15-6	15-2	14-8	14-4	14-1	13-8	13-5	13-2	12-9	12-6	12-3	12-1	11-8	11-6
10	16-2	15-8	15-4	15-0	14-6	14-2	13-9	13-6	13-3	13-0	12-7	12-4	12-2	11-9	11-7
14	16-4	16-0	15-6	15-2	14-8	14-4	14-1	13-8	13-5	13-2	12-9	12-6	12-4	12-1	11-9
18	16-7	16-3	15-9	15-5	15-1	14-7	14-4	14-1	13-7	13-4	13-1	12-9	12-6	12-4	12-1
20	16-9	16-5	16-0	15-6	15-3	14-9	14-6	14-2	13-9	13-6	13-3	13-0	12-8	12-5	12-3
22	17-1	16-7	16-3	15-8	15-5	15-1	14-7	14-4	14-1	13-8	13-5	13-2	12-9	12-7	12-4
24	17-4	16-9	16-5	16-1	15-7	15-3	14-9	14-6	14-3	14-0	13-7	13-4	13-1	12-8	12-6
26	17-6	17-2	16-7	16-3	15-9	15-5	15-2	14-8	14-5	14-2	13-9	13-6	13-3	13-1	12-8
28	17-9	17-5	17-0	16-6	16-2	15-8	15-4	15-1	14-8	14-4	14-1	13-8	13-5	13-3	13-0
30	18-3	17-8	17-3	16-9	16-5	16-1	15-7	15-4	15-0	14-7	14-4	14-1	13-8	13-5	13-3
31	18-4	18-0	17-5	17-1	16-7	16-3	15-9	15-5	15-2	14-9	14-5	14-2	13-9	13-7	13-4
32	18-6	18-1	17-7	17-2	16-8	16-4	16-0	15-7	15-3	15-0	14-7	14-4	14-1	13-8	13-5
33	18-8	18-3	17-9	17-4	17-0	16-6	16-2	15-8	15-5	15-2	14-9	14-5	14-2	14-0	13-7
34	19-0	18-5	18-1	17-6	17-2	16-8	16-4	16-0	15-7	15-3	15-0	14-7	14-4	14-1	13-8
35	19-2	18-7	18-3	17-8	17-4	17-0	16-6	16-2	15-9	15-5	15-2	14-9	14-6	14-3	14-0
36	19-5	19-0	18-5	18-0	17-6	17-2	16-8	16-4	16-1	15-7	15-4	15-0	14-7	14-4	14-2
37	19-7	19-2	18-7	18-2	17-8	17-4	17-0	16-6	16-3	15-9	15-6	15-2	14-9	14-6	14-3
38	19-9	19-4	18-9	18-5	18-0	17-6	17-2	16-8	16-5	16-1	15-8	15-4	15-1	14-8	14-5
39	20-2	19-7	19-2	18-7	18-3	17-8	17-4	17-0	16-7	16-3	16-0	15-6	15-3	15-0	14-7
40	20-5	19-9	19-4	19-0	18-5	18-1	17-7	17-3	16-9	16-5	16-2	15-8	15-5	15-2	14-9
41	20-7	20-2	19-7	19-2	18-8	18-3	17-9	17-5	17-1	16-8	16-4	16-1	15-7	15-4	15-1
42	21-0	20-5	20-0	19-5	19-0	18-6	18-2	17-8	17-4	17-0	16-7	16-3	16-0	15-7	15-4
43	21-3	20-8	20-3	19-8	19-3	18-9	18-4	18-0	17-6	17-3	16-9	16-6	16-2	15-9	15-6
44	21-7	21-1	20-6	20-1	19-6	19-2	18-7	18-3	17-9	17-5	17-2	16-8	16-5	16-2	15-8
45	22-0	21-4	20-9	20-4	19-9	19-5	19-0	18-6	18-2	17-8	17-5	17-1	16-8	16-4	16-1
46	22-4	21-8	21-3	20-8	20-3	19-8	19-3	18-9	18-5	18-1	17-8	17-4	17-1	16-7	16-4
47	22-7	22-2	21-6	21-1	20-6	20-1	19-7	19-2	18-8	18-4	18-1	17-7	17-4	17-0	16-7
48	23-1	22-5	22-0	21-5	21-0	20-5	20-0	19-6	19-2	18-8	18-4	18-0	17-7	17-3	17-0
49	23-5	22-9	22-4	21-9	21-4	20-9	20-4	19-9	19-5	19-1	18-7	18-3	18-0	17-6	17-3
50	24-0	23-4	22-8	22-3	21-8	21-3	20-8	20-3	19-9	19-5	19-1	18-7	18-3	18-0	17-6
51	24-4	23-8	23-3	22-7	22-2	21-7	21-2	20-7	20-3	19-9	19-5	19-1	18-7	18-3	18-0
52	24-9	24-3	23-7	23-1	22-6	22-1	21-6	21-1	20-7	20-3	19-9	19-5	19-1	18-7	18-3
53	25-4	24-8	24-2	23-6	23-1	22-6	22-1	21-6	21-2	20-7	20-3	19-9	19-5	19-1	18-7
54	25-9	25-3	24-7	24-1	23-6	23-1	22-6	22-1	21-6	21-1	20-7	20-3	19-9	19-5	19-1
55	26-5	25-8	25-2	24-6	24-1	23-6	23-1	22-6	22-1	21-6	21-2	20-8	20-4	20-0	19-6
56	27-1	26-4	25-8	25-2	24-6	24-1	23-6	23-1	22-6	22-1	21-7	21-3	20-8	20-4	20-1
57	27-7	27-0	26-4	25-8	25-2	24-7	24-1	23-6	23-1	22-7	22-2	21-8	21-3	20-9	20-6
58	28-3	27-7	27-0	26-4	25-8	25-3	24-7	24-2	23-7	23-2	22-8	22-3	21-9	21-5	21-1
59	29-0	28-4	27-7	27-1	26-5	25-9	25-3	24-8	24-3	23-8	23-4	22-9	22-5	22-0	21-6
60	29-8	29-1	28-4	27-8	27-2	26-6	26-0	25-5	24-9	24-4	24-0	23-5	23-1	22-6	22-2
61	30-5	29-8	29-1	28-5	27-9	27-3	26-7	26-2	25-6	25-1	24-6	24-2	23-7	23-3	22-8
62	31-3	30-6	29-9	29-3	28-7	28-0	27-5	26-9	26-4	25-8	25-3	24-8	24-4	23-9	23-5
63	32-2	31-5	30-8	30-1	29-5	28-8	28-2	27-7	27-1	26-6	26-1	25-6	25-1	24-6	24-2
64	33-1	32-4	31-7	31-0	30-3	29-7	29-1	28-5	27-9	27-4	26-9	26-4	25-9	25-4	25-0
65	34-1	33-3	32-6	31-9	31-2	30-6	30-0	29-4	28-8	28-3	27-8	27-2	26-7	26-2	25-8
66	35-1	34-3	33-6	32-9	32-2	31-6	30-9	30-3	29-8	29-2	28-7	28-1	27-6	27-1	26-7
67	36-2	35-4	34-7	34-0	33-3	32-6	32-0	31-4	30-8	30-2	29-6	29-1	28-6	28-1	27-6
68	37-3	36-6	35-8	35-1	34-4	33-7	33-1	32-4	31-8	31-2	30-7	30-1	29-6	29-1	28-6

$A \pm B = 3-50' \quad 3-60' \quad 3-70' \quad 3-80' \quad 3-90' \quad 4-00' \quad 4-10' \quad 4-20' \quad 4-30' \quad 4-40' \quad 4-50' \quad 4-60' \quad 4-70' \quad 4-80' \quad 4-90' \quad 5-00' = A \pm B$

A & B Same Names } RULE TO FIND { A & B Different names
 take Sum, (add) } C CORRECTION { take Difference (Sub.)
 C CORRECTION, ($A \pm B$) is named the same as the greater of these quantities.
 AZIMUTH takes combined names of C Correction and Hour Angle

TABLE C

TABLE C																	
A ± B = 5 00' 5 20'		5 40' 5 60'		5 80' 6 00'		A & B CORRECTION.				7 00' 7 20'		7 40' 7 60'		7 80' 8 00' = A ± B		Lat.	
						6 20'	6 40'	6 60'	6 80'								
AZIMUTHS																	
0	11.3	10.9	10.5	10.1	9.8	9.5	9.2	8.9	8.6	8.4	8.1	7.9	7.7	7.5	7.3	7.1	0
5	11.4	10.9	10.5	10.2	9.8	9.5	9.2	8.9	8.6	8.4	8.2	7.9	7.7	7.5	7.3	7.2	5
10	11.5	11.0	10.6	10.3	9.9	9.6	9.3	9.0	8.7	8.5	8.3	8.0	7.8	7.6	7.4	7.2	10
14	11.6	11.2	10.8	10.4	10.1	9.7	9.4	9.1	8.9	8.7	8.4	8.1	7.9	7.7	7.5	7.3	14
18	11.9	11.4	11.0	10.6	10.3	9.9	9.6	9.3	9.1	8.8	8.5	8.3	8.1	7.9	7.7	7.5	18
20	12.0	11.6	11.1	10.8	10.4	10.1	9.7	9.4	9.2	8.9	8.6	8.4	8.2	8.0	7.8	7.6	20
22	12.2	11.7	11.3	10.9	10.5	10.2	9.9	9.6	9.3	9.0	8.8	8.5	8.3	8.1	7.9	7.7	22
24	12.3	11.9	11.5	11.1	10.7	10.3	10.0	9.7	9.4	9.1	8.9	8.6	8.4	8.2	8.0	7.8	24
26	12.5	12.1	11.6	11.2	10.9	10.5	10.2	9.9	9.6	9.3	9.0	8.8	8.6	8.3	8.1	7.9	26
28	12.8	12.3	11.8	11.4	11.0	10.7	10.4	10.0	9.7	9.5	9.2	8.9	8.7	8.5	8.3	8.1	28
30	13.0	12.5	12.1	11.7	11.3	10.9	10.5	10.2	9.9	9.6	9.4	9.1	8.9	8.6	8.4	8.2	30
31	13.1	12.6	12.2	11.8	11.4	11.0	10.7	10.3	10.0	9.7	9.5	9.2	9.0	8.7	8.5	8.3	31
32	13.3	12.8	12.3	11.9	11.5	11.1	10.8	10.4	10.1	9.8	9.6	9.3	9.1	8.8	8.6	8.4	32
33	13.4	12.9	12.5	12.0	11.6	11.2	10.9	10.6	10.2	9.9	9.7	9.4	9.2	8.9	8.7	8.5	33
34	13.6	13.1	12.6	12.2	11.7	11.4	11.0	10.7	10.4	10.1	9.8	9.5	9.3	9.0	8.8	8.6	34
35	13.7	13.2	12.7	12.3	11.9	11.5	11.1	10.8	10.5	10.2	9.9	9.6	9.4	9.1	8.9	8.7	35
36	13.9	13.4	12.9	12.4	12.0	11.6	11.3	10.9	10.6	10.3	10.0	9.7	9.5	9.2	9.0	8.8	36
37	14.1	13.5	13.1	12.6	12.2	11.8	11.4	11.1	10.7	10.4	10.1	9.9	9.6	9.4	9.1	8.9	37
38	14.2	13.7	13.2	12.8	12.3	11.9	11.6	11.2	10.9	10.6	10.3	10.0	9.7	9.5	9.2	9.0	38
39	14.4	13.9	13.4	12.9	12.5	12.1	11.7	11.4	11.0	10.7	10.4	10.1	9.9	9.6	9.4	9.1	39
40	14.6	14.1	13.6	13.1	12.7	12.3	11.9	11.5	11.2	10.9	10.6	10.3	10.0	9.7	9.5	9.3	40
41	14.8	14.3	13.8	13.3	12.9	12.5	12.1	11.7	11.4	11.0	10.7	10.4	10.2	9.9	9.6	9.4	41
42	15.1	14.5	14.0	13.5	13.1	12.6	12.2	11.9	11.5	11.2	10.9	10.6	10.3	10.0	9.8	9.5	42
43	15.3	14.7	14.2	13.7	13.3	12.8	12.4	12.1	11.7	11.4	11.1	10.8	10.5	10.2	9.9	9.7	43
44	15.5	15.0	14.4	13.9	13.5	13.0	12.6	12.3	11.9	11.6	11.2	10.9	10.6	10.4	10.1	9.9	44
45	15.8	15.2	14.7	14.2	13.7	13.3	12.8	12.5	12.1	11.7	11.4	11.1	10.8	10.5	10.3	10.0	45
46	16.1	15.5	14.9	14.4	13.9	13.5	13.1	12.7	12.3	12.0	11.6	11.3	11.0	10.7	10.5	10.2	46
47	16.3	15.7	15.2	14.7	14.2	13.7	13.3	12.9	12.5	12.2	11.8	11.5	11.2	10.9	10.6	10.4	47
48	16.6	16.0	15.5	14.9	14.4	14.0	13.6	13.1	12.8	12.4	12.1	11.7	11.4	11.1	10.8	10.6	48
49	17.0	16.3	15.8	15.2	14.7	14.3	13.8	13.4	13.0	12.6	12.3	12.0	11.6	11.3	11.1	10.8	49
50	17.3	16.7	16.1	15.5	15.0	14.5	14.1	13.7	13.3	12.9	12.5	12.2	11.9	11.6	11.3	11.0	50
51	17.6	17.0	16.4	15.8	15.3	14.8	14.4	13.9	13.5	13.2	12.8	12.4	12.1	11.8	11.5	11.2	51
52	18.0	17.3	16.7	16.2	15.6	15.1	14.7	14.2	13.8	13.4	13.1	12.7	12.4	12.1	11.8	11.5	52
53	18.4	17.7	17.1	16.5	16.0	15.5	15.0	14.6	14.1	13.7	13.4	13.0	12.7	12.3	12.0	11.7	53
54	18.8	18.1	17.5	16.9	16.3	15.8	15.3	14.9	14.5	14.1	13.7	13.3	13.0	12.6	12.3	12.0	54
55	19.2	18.5	17.9	17.3	16.7	16.2	15.7	15.2	14.8	14.4	14.0	13.6	13.3	12.9	12.6	12.3	55
56	19.7	19.0	18.3	17.7	17.1	16.6	16.1	15.6	15.2	14.7	14.3	13.9	13.6	13.2	12.9	12.6	56
57	20.2	19.5	18.8	18.2	17.6	17.0	16.5	16.0	15.5	15.1	14.7	14.3	13.9	13.6	13.2	12.9	57
58	20.7	20.0	19.3	18.6	18.0	17.5	16.9	16.4	16.0	15.5	15.1	14.7	14.3	13.9	13.6	13.3	58
59	21.2	20.5	19.8	19.1	18.5	17.9	17.4	16.9	16.4	15.9	15.5	15.1	14.7	14.3	14.0	13.6	59
60	21.8	21.0	20.3	19.7	19.0	18.4	17.9	17.4	16.9	16.4	15.9	15.5	15.1	14.7	14.4	14.0	60
61	22.4	21.6	20.9	20.2	19.6	19.0	18.4	17.9	17.4	16.9	16.4	16.0	15.6	15.2	14.8	14.5	61
62	23.1	22.3	21.5	20.8	20.2	19.6	19.0	18.4	17.9	17.4	16.9	16.5	16.1	15.7	15.3	14.9	62
63	23.8	23.0	22.2	21.5	20.8	20.2	19.6	19.0	18.5	18.0	17.5	17.0	16.6	16.2	15.8	15.4	63
64	24.5	23.7	22.9	22.2	21.5	20.8	20.2	19.6	19.1	18.6	18.1	17.6	17.1	16.7	16.3	15.9	64
65	25.3	24.5	23.7	23.0	22.2	21.5	20.9	20.3	19.7	19.2	18.7	18.2	17.7	17.3	16.9	16.5	65
66	26.2	25.3	24.5	23.7	23.0	22.3	21.6	21.0	20.4	19.9	19.4	18.9	18.4	17.9	17.5	17.1	66
67	27.1	26.2	25.4	24.6	23.8	23.1	22.4	21.8	21.2	20.6	20.1	19.6	19.1	18.6	18.2	17.8	67
68	28.1	27.2	26.3	25.5	24.7	24.0	23.3	22.6	22.0	21.4	20.9	20.3	19.8	19.4	18.9	18.5	68
Lat.																	
A ± B = 5 00'	5 20'	5 40'	5 60'	5 80'	6 00'	6 20'	6 40'	6 60'	6 80'	7 00'	7 20'	7 40'	7 60'	7 80'	8 00'	= A ± B	

A & B Same Names } RULE TO FIND { A & B Different names
 take Sum, (add) } C CORRECTION { take Difference (Sub.)

C CORRECTION, (A ± B) is named the same as the greater of these quantities.

AZIMUTH takes combined names of C Correction and Hour Angle

TABLE C

A ± B = 8 00' 8 20'		8 40' 8 60'		8 80' 9 00'		A & B CORRECTION.				10 0' 10 3'		10 6' 11 0'		11 5' 12 0' = A ± B	
						AZIMUTHS									
Lat	°	°	°	°	°	°	°	°	°	°	°	°	°	°	Lat
0	7.1	7.0	6.8	6.6	6.5	6.3	6.2	6.1	5.9	5.8	5.7	5.5	5.4	5.2	0
5	7.2	7.0	6.8	6.7	6.5	6.4	6.2	6.1	6.0	5.8	5.7	5.6	5.4	5.2	5
10	7.2	7.1	6.9	6.7	6.6	6.4	6.3	6.2	6.0	5.9	5.8	5.6	5.5	5.3	10
14	7.3	7.2	7.0	6.8	6.7	6.5	6.4	6.3	6.1	6.0	5.9	5.7	5.6	5.4	14
18	7.5	7.3	7.1	7.0	6.8	6.7	6.5	6.4	6.3	6.1	6.0	5.8	5.7	5.5	18
20	7.6	7.4	7.2	7.1	6.9	6.7	6.6	6.5	6.3	6.2	6.1	5.9	5.7	5.5	20
22	7.7	7.5	7.3	7.1	7.0	6.8	6.7	6.5	6.4	6.3	6.2	6.0	5.8	5.6	22
24	7.8	7.6	7.4	7.3	7.1	6.9	6.8	6.6	6.5	6.4	6.2	6.1	5.9	5.7	24
26	7.9	7.7	7.5	7.4	7.2	7.0	6.9	6.7	6.6	6.5	6.3	6.2	6.0	5.8	26
28	8.1	7.9	7.7	7.5	7.3	7.2	7.0	6.9	6.7	6.6	6.5	6.3	6.1	5.9	28
30	8.2	8.0	7.8	7.6	7.5	7.3	7.2	7.0	6.9	6.7	6.6	6.4	6.2	6.0	30
31	8.3	8.1	7.9	7.7	7.6	7.4	7.2	7.1	6.9	6.8	6.7	6.5	6.3	6.1	31
32	8.4	8.2	8.0	7.8	7.6	7.5	7.3	7.2	7.0	6.9	6.7	6.5	6.3	6.1	32
33	8.5	8.3	8.1	7.9	7.7	7.5	7.4	7.2	7.1	6.9	6.8	6.6	6.4	6.2	33
34	8.6	8.4	8.2	8.0	7.8	7.6	7.5	7.3	7.2	7.0	6.9	6.7	6.5	6.3	34
35	8.7	8.5	8.3	8.1	7.9	7.7	7.6	7.4	7.2	7.1	7.0	6.8	6.6	6.3	35
36	8.8	8.6	8.4	8.2	8.0	7.8	7.7	7.5	7.3	7.2	7.0	6.8	6.7	6.4	36
37	8.9	8.7	8.5	8.3	8.1	7.9	7.8	7.6	7.4	7.3	7.1	6.9	6.7	6.5	37
38	9.0	8.8	8.6	8.4	8.2	8.0	7.9	7.7	7.5	7.4	7.2	7.0	6.9	6.6	38
39	9.1	8.9	8.7	8.5	8.3	8.1	8.0	7.8	7.6	7.5	7.3	7.1	6.9	6.7	39
40	9.3	9.0	8.8	8.6	8.4	8.3	8.1	7.9	7.7	7.6	7.4	7.2	7.0	6.8	40
41	9.4	9.2	9.0	8.8	8.6	8.4	8.2	8.0	7.9	7.7	7.5	7.3	7.1	6.9	41
42	9.5	9.3	9.1	8.9	8.7	8.5	8.3	8.1	8.0	7.8	7.7	7.4	7.2	7.0	42
43	9.7	9.5	9.2	9.0	8.8	8.6	8.5	8.3	8.1	7.9	7.8	7.6	7.4	7.1	43
44	9.9	9.6	9.4	9.2	8.9	8.8	8.6	8.4	8.2	8.1	7.9	7.7	7.5	7.2	44
45	10.0	9.8	9.6	9.3	9.1	8.9	8.7	8.6	8.4	8.2	8.0	7.8	7.6	7.3	45
46	10.2	10.0	9.7	9.5	9.3	9.1	8.9	8.7	8.5	8.4	8.2	8.0	7.7	7.5	46
47	10.4	10.1	9.9	9.7	9.5	9.3	9.1	8.9	8.7	8.5	8.3	8.1	7.9	7.6	47
48	10.6	10.3	10.1	9.9	9.6	9.4	9.2	9.0	8.8	8.7	8.5	8.3	8.0	7.7	48
49	10.8	10.5	10.3	10.1	9.8	9.6	9.4	9.2	9.0	8.8	8.7	8.4	8.2	7.9	49
50	11.0	10.7	10.5	10.3	10.0	9.8	9.6	9.4	9.2	9.0	8.8	8.6	8.3	8.0	50
51	11.2	11.0	10.7	10.5	10.2	10.0	9.8	9.6	9.4	9.2	9.0	8.8	8.5	8.2	51
52	11.5	11.2	10.9	10.7	10.5	10.2	10.0	9.8	9.6	9.4	9.2	9.0	8.7	8.4	52
53	11.7	11.5	11.2	10.9	10.7	10.5	10.2	10.0	9.8	9.6	9.4	9.2	8.9	8.6	53
54	12.0	11.7	11.4	11.2	10.9	10.7	10.5	10.3	10.0	9.8	9.7	9.4	9.1	8.8	54
55	12.3	12.0	11.7	11.5	11.2	11.0	10.7	10.5	10.3	10.1	9.9	9.6	9.3	9.0	55
56	12.6	12.3	12.0	11.7	11.5	11.2	11.0	10.8	10.6	10.3	10.1	9.8	9.6	9.2	56
57	12.9	12.6	12.3	12.1	11.8	11.5	11.3	11.1	10.8	10.6	10.4	10.1	9.8	9.5	57
58	13.3	13.0	12.7	12.4	12.1	11.8	11.6	11.4	11.1	10.9	10.7	10.4	10.1	9.7	58
59	13.6	13.3	13.0	12.7	12.4	12.2	11.9	11.7	11.4	11.2	11.0	10.7	10.4	10.0	59
60	14.0	13.7	13.4	13.1	12.8	12.5	12.3	12.0	11.8	11.5	11.3	11.0	10.7	10.3	60
61	14.5	14.1	13.8	13.5	13.2	12.9	12.6	12.4	12.1	11.9	11.7	11.3	11.0	10.6	61
62	14.9	14.6	14.2	13.9	13.6	13.3	13.0	12.8	12.5	12.3	12.0	11.7	11.4	11.0	62
63	15.4	15.0	14.7	14.4	14.1	13.8	13.5	13.2	12.9	12.7	12.4	12.1	11.7	11.3	63
64	15.9	15.5	15.2	14.9	14.5	14.2	13.9	13.6	13.4	13.1	12.9	12.5	12.1	11.7	64
65	16.5	16.1	15.7	15.4	15.1	14.7	14.4	14.1	13.8	13.6	13.3	12.9	12.6	12.1	65
66	17.1	16.7	16.3	16.0	15.6	15.3	15.0	14.7	14.4	14.1	13.8	13.4	13.1	12.6	66
67	17.8	17.3	16.9	16.6	16.2	15.9	15.5	15.2	14.9	14.6	14.4	14.0	13.6	13.1	67
68	18.5	18.0	17.6	17.2	16.9	16.5	16.2	15.9	15.5	15.2	14.9	14.6	14.2	13.6	68

A & B Same Names } RULE TO FIND { A & B Different names
 take Sum. (add) } C CORRECTION { take Difference (Sub.)
 C CORRECTION, (A ± B) is named the same as the greater of these quantities.
 AZIMUTH takes combined names of C Correction and Hour Angle

TABLE C

TABLE C																												
A±B=12 0' 12 5'			13 0' 13 5'		14 0' 14 5'		A & B CORRECTION.				19 0' 20 0'		21 0' 22 0'		23 0' 25 0'		A±B											
							15 0'	16 0'	17 0'	18 0'																		
Lat	°		°		°		°		°		°		°		°		°		Lat									
AZIMUTHS																				Lat								
0	4.8	4.6	4.4	4.2	4.1	3.9	3.8	3.6	3.4	3.2	3.0	2.9	2.7	2.6	2.5	2.3	0											
5	4.8	4.6	4.4	4.3	4.1	4.0	3.8	3.6	3.4	3.2	3.0	2.9	2.7	2.6	2.5	2.3	5											
10	4.8	4.6	4.5	4.3	4.1	4.0	3.9	3.6	3.4	3.2	3.1	2.9	2.8	2.6	2.5	2.3	10											
14	4.9	4.7	4.5	4.4	4.2	4.1	3.9	3.7	3.5	3.3	3.1	2.9	2.8	2.7	2.6	2.4	14											
18	5.0	4.8	4.6	4.4	4.3	4.1	4.0	3.8	3.5	3.3	3.2	3.0	2.9	2.7	2.6	2.4	18											
20	5.1	4.9	4.7	4.5	4.3	4.2	4.1	3.8	3.6	3.4	3.2	3.0	2.9	2.8	2.6	2.4	20											
22	5.1	4.9	4.7	4.6	4.4	4.3	4.1	3.9	3.6	3.4	3.3	3.1	2.9	2.8	2.7	2.5	22											
24	5.2	5.0	4.8	4.6	4.5	4.3	4.2	3.9	3.7	3.5	3.3	3.1	3.0	2.8	2.7	2.5	24											
26	5.3	5.1	4.9	4.7	4.5	4.4	4.2	4.0	3.7	3.5	3.4	3.2	3.0	2.9	2.8	2.5	26											
28	5.4	5.2	5.0	4.8	4.6	4.5	4.3	4.0	3.8	3.6	3.4	3.2	3.1	2.9	2.8	2.6	28											
30	5.5	5.3	5.1	4.9	4.7	4.6	4.4	4.1	3.9	3.7	3.5	3.3	3.1	3.0	2.9	2.6	30											
31	5.6	5.3	5.1	4.9	4.8	4.6	4.4	4.2	3.9	3.7	3.5	3.3	3.2	3.0	2.9	2.7	31											
32	5.6	5.4	5.2	5.0	4.8	4.6	4.5	4.2	4.0	3.7	3.6	3.4	3.2	3.1	2.9	2.7	32											
33	5.7	5.4	5.2	5.0	4.9	4.7	4.5	4.3	4.0	3.8	3.6	3.4	3.2	3.1	3.0	2.7	33											
34	5.7	5.5	5.3	5.1	4.9	4.8	4.6	4.3	4.1	3.8	3.6	3.5	3.3	3.1	3.0	2.8	34											
35	5.8	5.6	5.4	5.2	5.0	4.8	4.7	4.4	4.1	3.9	3.7	3.5	3.3	3.2	3.0	2.8	35											
36	5.9	5.7	5.4	5.2	5.0	4.9	4.7	4.4	4.2	3.9	3.7	3.5	3.4	3.2	3.1	2.8	36											
37	6.0	5.7	5.5	5.3	5.1	4.9	4.8	4.5	4.2	4.0	3.8	3.6	3.4	3.3	3.1	2.9	37											
38	6.0	5.8	5.6	5.4	5.2	5.0	4.8	4.5	4.3	4.0	3.8	3.6	3.5	3.3	3.2	2.9	38											
39	6.1	5.9	5.7	5.5	5.3	5.1	4.9	4.6	4.3	4.1	3.9	3.7	3.5	3.3	3.2	2.9	39											
40	6.2	6.0	5.7	5.5	5.3	5.2	5.0	4.7	4.4	4.1	3.9	3.7	3.6	3.4	3.2	3.0	40											
41	6.3	6.1	5.8	5.6	5.4	5.2	5.0	4.7	4.5	4.2	4.0	3.8	3.6	3.4	3.3	3.0	41											
42	6.4	6.1	5.9	5.7	5.5	5.3	5.1	4.8	4.5	4.3	4.1	3.8	3.7	3.5	3.3	3.1	42											
43	6.5	6.2	6.0	5.8	5.6	5.4	5.2	4.9	4.6	4.3	4.1	3.9	3.7	3.6	3.4	3.1	43											
44	6.6	6.3	6.1	5.9	5.7	5.5	5.3	5.0	4.7	4.4	4.2	4.0	3.8	3.6	3.5	3.2	44											
45	6.7	6.5	6.2	6.0	5.8	5.6	5.4	5.1	4.8	4.5	4.3	4.0	3.9	3.7	3.5	3.2	45											
46	6.8	6.6	6.3	6.1	5.9	5.7	5.5	5.1	4.8	4.6	4.3	4.1	3.9	3.7	3.6	3.3	46											
47	7.0	6.7	6.4	6.2	6.0	5.8	5.6	5.2	4.9	4.7	4.4	4.2	4.0	3.8	3.6	3.4	47											
48	7.1	6.8	6.6	6.3	6.1	5.9	5.7	5.3	5.0	4.7	4.5	4.3	4.1	3.9	3.7	3.4	48											
49	7.2	7.0	6.7	6.4	6.2	6.0	5.8	5.4	5.1	4.8	4.6	4.4	4.2	4.0	3.8	3.5	49											
50	7.4	7.1	6.8	6.6	6.3	6.1	5.9	5.6	5.2	4.9	4.7	4.4	4.2	4.0	3.9	3.6	50											
51	7.5	7.2	7.0	6.7	6.5	6.2	6.0	5.7	5.3	5.0	4.8	4.5	4.3	4.1	4.0	3.6	51											
52	7.7	7.4	7.1	6.9	6.6	6.4	6.2	5.8	5.5	5.2	4.9	4.6	4.4	4.2	4.0	3.7	52											
53	7.9	7.6	7.3	7.0	6.8	6.5	6.3	5.9	5.6	5.3	5.0	4.7	4.5	4.3	4.1	3.8	53											
54	8.1	7.8	7.5	7.2	6.9	6.7	6.5	6.1	5.7	5.4	5.1	4.9	4.6	4.4	4.2	3.9	54											
55	8.3	7.9	7.6	7.4	7.1	6.9	6.6	6.2	5.9	5.5	5.2	5.0	4.7	4.5	4.3	4.0	55											
56	8.5	8.1	7.8	7.5	7.3	7.0	6.8	6.4	6.0	5.7	5.4	5.1	4.9	4.6	4.4	4.1	56											
57	8.7	8.4	8.0	7.7	7.5	7.2	7.0	6.5	6.2	5.8	5.5	5.2	5.0	4.8	4.6	4.2	57											
58	8.9	8.6	8.3	8.0	7.7	7.4	7.2	6.7	6.3	6.0	5.7	5.4	5.1	4.9	4.7	4.3	58											
59	9.2	8.8	8.5	8.2	7.9	7.6	7.4	6.9	6.5	6.2	5.8	5.5	5.3	5.0	4.8	4.4	59											
60	9.5	9.1	8.7	8.4	8.1	7.9	7.6	7.1	6.7	6.3	6.0	5.7	5.4	5.2	5.0	4.6	60											
61	9.8	9.4	9.0	8.7	8.4	8.1	7.8	7.3	6.9	6.5	6.2	5.9	5.6	5.4	5.1	4.7	61											
62	10.1	9.7	9.3	9.0	8.7	8.4	8.1	7.6	7.1	6.7	6.4	6.1	5.8	5.5	5.3	4.9	62											
63	10.4	10.0	9.6	9.3	8.9	8.6	8.4	7.8	7.4	7.0	6.6	6.3	6.0	5.7	5.5	5.0	63											
64	10.8	10.3	10.0	9.6	9.3	8.9	8.6	8.1	7.6	7.2	6.8	6.5	6.2	5.9	5.7	5.2	64											
65	11.2	10.7	10.3	9.9	9.6	9.3	9.0	8.4	7.9	7.5	7.1	6.7	6.4	6.1	5.9	5.4	65											
66	11.6	11.1	10.7	10.3	10.0	9.6	9.3	8.7	8.2	7.8	7.4	7.0	6.7	6.4	6.1	5.6	66											
67	12.0	11.6	11.1	10.7	10.4	10.0	9.7	9.1	8.6	8.1	7.7	7.3	6.9	6.6	6.3	5.8	67											
68	12.5	12.1	11.6	11.2	10.8	10.4	10.1	9.5	8.9	8.4	8.0	7.6	7.2	6.9	6.6	6.1	68											
Lat	°		°		°		°		°		°		°		°		Lat											
A±B=12 0' 12 5'			13 0' 13 5'		14 0' 14 5'		15 0' 16 0'		17 0' 18 0'		19 0' 20 0'		21 0' 22 0'		23 0' 25 0'		A±B											

$A \pm B = 12\ 0'$ 12 5' 13 0' 13 5' 14 0' 14 5' 15 0' 16 0' 17 0' 18 0' 19 0' 20 0' 21 0' 22 0' 23 0' 25 0' = $A \pm B$

A & B Same Names } RULE TO FIND { A & B Different names
 take Sum, (add). } C CORRECTION { take Difference (Sub.)
 C CORRECTION, ($A \pm B$) is named the same as the greater of these quantities.
 AZIMUTH takes combined names of C Correction and Hour Angle

TABLE C

A ± B		25 0' 27 0'		30 0' 33 0'		36 0' 40 0'		A & B CORRECTION.				80 0' 100'		150' 200'		400' 800' - A ± B	
Lat	Long							AZIMUTHS									
		°	'	°	'	°	'	°	'	°	'	°	'	°	'	°	'
0		2.3	2.1	1.9	1.7	1.6	1.4	1.3	1.1	1.0	0.8	0.7	0.6	0.4	0.3	0.1	0.1
5		2.3	2.1	1.9	1.7	1.6	1.4	1.3	1.2	1.0	0.8	0.7	0.6	0.4	0.3	0.1	0.1
10		2.3	2.2	1.9	1.8	1.6	1.5	1.3	1.2	1.0	0.8	0.7	0.6	0.4	0.3	0.1	0.1
14		2.4	2.2	2.0	1.8	1.6	1.5	1.3	1.2	1.0	0.8	0.7	0.6	0.4	0.3	0.1	0.1
18		2.4	2.2	2.0	1.8	1.7	1.5	1.3	1.2	1.0	0.9	0.8	0.6	0.4	0.3	0.2	0.1
20		2.4	2.2	2.0	1.8	1.7	1.5	1.4	1.2	1.0	0.9	0.8	0.6	0.4	0.3	0.2	0.1
22		2.5	2.3	2.1	1.9	1.7	1.5	1.4	1.2	1.0	0.9	0.8	0.6	0.4	0.3	0.2	0.1
24		2.5	2.3	2.1	1.9	1.7	1.6	1.4	1.3	1.0	0.9	0.8	0.6	0.4	0.3	0.2	0.1
26		2.5	2.4	2.1	1.9	1.8	1.6	1.4	1.3	1.1	0.9	0.8	0.6	0.4	0.3	0.2	0.1
28		2.6	2.4	2.2	2.0	1.8	1.6	1.4	1.3	1.1	0.9	0.8	0.6	0.4	0.3	0.2	0.1
30		2.6	2.4	2.2	2.0	1.8	1.7	1.5	1.3	1.1	0.9	0.8	0.7	0.4	0.3	0.2	0.1
31		2.7	2.5	2.2	2.0	1.9	1.7	1.5	1.3	1.1	1.0	0.8	0.7	0.4	0.3	0.2	0.1
32		2.7	2.5	2.3	2.0	1.9	1.7	1.5	1.4	1.1	1.0	0.8	0.7	0.5	0.3	0.2	0.1
33		2.7	2.5	2.3	2.1	1.9	1.7	1.5	1.4	1.1	1.0	0.9	0.7	0.5	0.3	0.2	0.1
34		2.8	2.6	2.3	2.1	1.9	1.7	1.5	1.4	1.2	1.0	0.9	0.7	0.5	0.3	0.2	0.1
35		2.8	2.6	2.3	2.1	2.0	1.7	1.6	1.4	1.2	1.0	0.9	0.7	0.5	0.3	0.2	0.1
36		2.8	2.6	2.4	2.1	2.0	1.8	1.6	1.4	1.2	1.0	0.9	0.7	0.5	0.4	0.2	0.1
37		2.9	2.7	2.4	2.2	2.0	1.8	1.6	1.4	1.2	1.0	0.9	0.7	0.5	0.4	0.2	0.1
38		2.9	2.7	2.4	2.2	2.0	1.8	1.6	1.5	1.2	1.0	0.9	0.7	0.5	0.4	0.2	0.1
39		2.9	2.7	2.5	2.2	2.0	1.8	1.6	1.5	1.2	1.0	0.9	0.7	0.5	0.4	0.2	0.1
40		3.0	2.8	2.5	2.3	2.1	1.9	1.7	1.5	1.2	1.1	0.9	0.7	0.5	0.4	0.2	0.1
41		3.0	2.8	2.5	2.3	2.1	1.9	1.7	1.5	1.3	1.1	1.0	0.8	0.5	0.4	0.2	0.1
42		3.1	2.9	2.6	2.3	2.1	1.9	1.7	1.5	1.3	1.1	1.0	0.8	0.5	0.4	0.2	0.1
43		3.1	2.9	2.6	2.4	2.2	2.0	1.7	1.6	1.3	1.1	1.0	0.8	0.5	0.4	0.2	0.1
44		3.2	2.9	2.7	2.4	2.2	2.0	1.8	1.6	1.3	1.1	1.0	0.8	0.5	0.4	0.2	0.1
45		3.2	3.0	2.7	2.5	2.2	2.0	1.8	1.6	1.4	1.2	1.0	0.8	0.5	0.4	0.2	0.1
46		3.3	3.1	2.7	2.5	2.3	2.1	1.8	1.6	1.4	1.2	1.0	0.8	0.5	0.4	0.2	0.1
47		3.4	3.1	2.8	2.5	2.3	2.1	1.9	1.7	1.4	1.2	1.1	0.8	0.6	0.4	0.2	0.1
48		3.4	3.2	2.9	2.6	2.4	2.1	1.9	1.7	1.4	1.2	1.1	0.9	0.6	0.4	0.2	0.1
49		3.5	3.2	2.9	2.6	2.4	2.2	1.9	1.7	1.5	1.2	1.1	0.9	0.6	0.4	0.2	0.1
50		3.6	3.3	3.0	2.7	2.5	2.2	2.0	1.8	1.5	1.3	1.1	0.9	0.6	0.4	0.2	0.1
51		3.6	3.4	3.0	2.8	2.5	2.3	2.0	1.8	1.5	1.3	1.2	0.9	0.6	0.5	0.2	0.1
52		3.7	3.4	3.1	2.8	2.6	2.3	2.1	1.9	1.6	1.3	1.2	0.9	0.6	0.5	0.2	0.1
53		3.8	3.5	3.2	2.9	2.6	2.4	2.1	1.9	1.6	1.4	1.2	1.0	0.6	0.5	0.2	0.1
54		3.9	3.6	3.2	3.0	2.7	2.4	2.2	1.9	1.6	1.4	1.2	1.0	0.6	0.5	0.2	0.1
55		4.0	3.7	3.3	3.0	2.8	2.5	2.2	2.0	1.7	1.4	1.2	1.0	0.7	0.5	0.2	0.1
56		4.1	3.8	3.4	3.1	2.8	2.6	2.3	2.0	1.7	1.5	1.3	1.0	0.7	0.5	0.3	0.1
57		4.2	3.9	3.5	3.2	2.9	2.6	2.3	2.1	1.8	1.5	1.3	1.1	0.7	0.5	0.3	0.1
58		4.3	4.0	3.6	3.3	3.0	2.7	2.4	2.2	1.8	1.5	1.4	1.1	0.7	0.5	0.3	0.1
59		4.4	4.1	3.7	3.4	3.1	2.8	2.5	2.2	1.9	1.6	1.4	1.1	0.7	0.6	0.3	0.1
60		4.6	4.2	3.8	3.5	3.2	2.9	2.5	2.3	1.9	1.6	1.4	1.1	0.8	0.6	0.3	0.1
61		4.7	4.4	3.9	3.6	3.3	3.0	2.6	2.4	2.0	1.7	1.5	1.2	0.8	0.6	0.3	0.1
62		4.9	4.5	4.1	3.7	3.4	3.0	2.7	2.4	2.0	1.7	1.5	1.2	0.8	0.6	0.3	0.2
63		5.0	4.7	4.2	3.8	3.5	3.2	2.8	2.5	2.1	1.8	1.6	1.3	0.8	0.6	0.3	0.2
64		5.2	4.8	4.3	4.0	3.6	3.3	2.9	2.6	2.2	1.9	1.6	1.3	0.9	0.7	0.3	0.2
65		5.4	5.0	4.5	4.1	3.8	3.4	3.0	2.7	2.3	1.9	1.7	1.4	0.9	0.7	0.3	0.2
66		5.6	5.2	4.7	4.3	3.9	3.5	3.1	2.8	2.3	2.0	1.8	1.4	0.9	0.7	0.4	0.2
67		5.8	5.4	4.9	4.4	4.1	3.7	3.3	2.9	2.4	2.1	1.8	1.5	1.0	0.7	0.4	0.2
68		6.1	5.6	5.1	4.6	4.2	3.8	3.4	3.1	2.5	2.2	1.9	1.5	1.0	0.8	0.4	0.2

A & B Same Names } RULE TO FIND { A & B Different names
 take Sum, (add) } C CORRECTION { take Difference (Sub.)
 C CORRECTION, (A - B) is named the same as the greater of these quantities.
 AZIMUTH takes combined names of C Correction and Hour Angle

TABLE C

A ± B = 00' 01'		02' 03'		04' 05'		A & B CORRECTION				10' 11'		12' 13'		14' 15' = A ± B	
						06' 07'	08' 09'								
Lat. °	°	°	°	°	°	AZIMUTHS				°	°	°	°	°	Lat. °
68	90.0	89.8	89.6	89.4	89.1	88.9	88.7	88.5	88.3	88.1	87.9	87.6	87.4	87.2	68
69	90.0	89.8	89.6	89.4	89.2	89.0	88.8	88.6	88.4	88.2	88.0	87.7	87.5	87.3	69
70	90.0	89.8	89.6	89.4	89.2	89.0	88.8	88.6	88.4	88.2	88.0	87.8	87.7	87.5	70
71	90.0	89.8	89.6	89.4	89.3	89.1	88.9	88.7	88.5	88.3	88.1	87.9	87.8	87.6	71
72	90.0	89.8	89.6	89.5	89.3	89.1	88.9	88.8	88.6	88.4	88.2	88.1	87.9	87.7	72
73	90.0	89.8	89.7	89.5	89.3	89.2	89.0	88.8	88.7	88.5	88.3	88.2	88.0	87.8	73
74	90.0	89.8	89.7	89.5	89.4	89.2	89.0	88.9	88.7	88.6	88.4	88.3	88.1	87.9	74
75	90.0	89.9	89.7	89.6	89.4	89.3	89.1	89.0	88.8	88.7	88.5	88.4	88.2	88.1	75
76	90.0	89.9	89.7	89.6	89.4	89.3	89.2	89.0	88.9	88.8	88.6	88.5	88.3	88.2	76
77	90.0	89.9	89.7	89.6	89.5	89.4	89.2	89.1	89.0	88.8	88.7	88.6	88.5	88.3	77
78	90.0	89.9	89.8	89.6	89.5	89.4	89.3	89.2	89.0	88.9	88.8	88.7	88.6	88.5	78
79	90.0	89.9	89.8	89.7	89.6	89.5	89.4	89.2	89.1	89.0	88.9	88.8	88.7	88.6	79
80	90.0	89.9	89.8	89.7	89.6	89.5	89.4	89.3	89.2	89.1	89.0	88.9	88.8	88.7	80

TABLE C

A ± B = 15' 16'		17' 18'		19' 20'		A & B CORRECTION				25' 26'		27' 28'		29' 30' = A ± B	
						21' 22'	23' 24'								
Lat. °	°	°	°	°	°	AZIMUTHS				°	°	°	°	°	Lat. °
68	86.8	86.6	86.4	86.1	85.9	85.7	85.5	85.3	85.1	84.9	84.6	84.4	84.2	84.0	68
69	86.9	86.7	86.5	86.3	86.1	85.9	85.7	85.5	85.3	85.1	84.9	84.7	84.5	84.3	69
70	87.1	86.9	86.7	86.5	86.3	86.1	85.9	85.7	85.5	85.3	85.1	84.9	84.7	84.5	70
71	87.2	87.0	86.8	86.6	86.5	86.3	86.1	85.9	85.7	85.5	85.3	84.2	85.0	84.8	71
72	87.3	87.2	87.0	86.8	86.6	86.5	86.3	86.1	85.9	85.8	85.6	85.4	85.2	85.1	72
73	87.5	87.3	87.2	87.0	86.8	86.7	86.5	86.3	86.2	86.0	85.8	85.6	85.5	85.3	73
74	87.6	87.5	87.3	87.2	87.0	86.8	86.7	86.5	86.4	86.2	86.1	85.9	85.7	85.6	74
75	87.8	87.6	87.5	87.3	87.2	87.0	86.9	86.7	86.6	86.4	86.3	86.2	86.0	85.9	75
76	87.9	87.8	87.6	87.5	87.4	87.2	87.1	87.0	86.8	86.7	86.5	86.4	86.3	86.1	76
77	88.1	87.9	87.8	87.7	87.6	87.4	87.3	87.2	87.0	86.9	86.8	86.7	86.5	86.4	77
78	88.2	88.1	88.0	87.9	87.7	87.6	87.5	87.4	87.3	87.1	87.0	86.9	86.8	86.7	78
79	88.4	88.3	88.1	88.0	87.9	87.8	87.7	87.6	87.5	87.4	87.3	87.2	87.1	86.9	79
80	88.5	88.4	88.3	88.2	88.1	88.0	87.9	87.8	87.7	87.6	87.5	87.4	87.3	87.2	80

TABLE C

A ± B = 30' 31'		32' 33'		34' 35'		A & B CORRECTION				40' 41'		42' 43'		44' 45' = A ± B	
						36' 37'	38' 39'								
Lat. °	°	°	°	°	°	AZIMUTHS				°	°	°	°	°	Lat. °
68	83.6	83.4	83.2	83.0	82.7	82.5	82.3	82.1	81.9	81.7	81.5	81.3	81.1	80.8	68
69	83.9	83.7	83.5	83.3	83.1	82.9	82.7	82.5	82.3	82.0	81.8	81.6	81.4	81.2	69
70	84.1	83.9	83.7	83.6	83.4	83.2	83.0	82.8	82.6	82.4	82.2	82.0	81.8	81.6	70
71	84.4	84.2	84.0	83.9	83.7	83.5	83.3	83.1	83.0	82.8	82.6	82.4	82.2	82.0	71
72	84.7	84.5	84.4	84.2	84.0	83.8	83.7	83.5	83.3	83.1	83.0	82.8	82.6	82.4	72
73	85.0	84.8	84.7	84.5	84.3	84.2	84.0	83.8	83.7	83.5	83.3	83.2	83.0	82.8	73
74	85.3	85.1	85.0	84.8	84.6	84.5	84.3	84.2	84.0	83.9	83.7	83.6	83.4	83.2	74
75	85.6	85.4	85.3	85.1	85.0	84.8	84.7	84.5	84.4	84.2	84.1	83.9	83.8	83.7	75
76	85.9	85.7	85.6	85.4	85.3	85.2	85.0	84.9	84.8	84.6	84.5	84.3	84.2	84.1	76
77	86.1	86.0	85.9	85.8	85.6	85.5	85.4	85.2	85.1	85.0	84.9	84.7	84.6	84.5	77
78	86.4	85.3	86.2	86.1	86.0	85.8	85.7	85.6	85.5	85.4	85.3	85.1	85.0	84.9	78
79	86.7	86.6	86.5	86.4	86.3	86.2	86.1	86.0	85.9	85.7	85.6	85.5	85.4	85.3	79
80	87.0	86.9	86.8	86.7	86.6	86.5	86.4	86.3	86.2	86.1	86.0	85.9	85.8	85.7	80

C

TABLE C

A ± B = 45' 46'		-47' -48'		-49' -50'		A & B CORRECTION				55' 56'		57' 58'		59' 60' = A ± B	
						51'	52'	53'	54'						
Lat.	°		°		°		AZIMUTHS				°		°		Lat.
68	80.4	80.2	80.0	79.8	79.6	79.4	79.2	79.0	78.8	78.6	78.4	78.2	77.9	77.7	68
69	80.8	80.6	80.4	80.2	80.0	79.8	79.6	79.5	79.3	79.1	78.9	78.7	78.5	78.3	69
70	81.3	81.1	80.9	80.7	80.5	80.3	80.1	79.9	79.7	79.5	79.4	79.2	79.0	78.8	70
71	81.7	81.5	81.3	81.1	80.9	80.8	80.6	80.4	80.2	80.0	79.9	79.7	79.5	79.3	71
72	82.1	81.9	81.7	81.6	81.4	81.2	81.0	80.9	80.7	80.5	80.4	80.2	80.0	79.8	72
73	82.5	82.3	82.2	82.0	81.9	81.7	81.5	81.4	81.2	81.0	80.9	80.7	80.5	80.4	73
74	82.9	82.8	82.6	82.5	82.3	82.2	82.0	81.9	81.7	81.5	81.4	81.2	81.1	80.9	74
75	83.4	83.2	83.1	82.9	82.8	82.6	82.5	82.3	82.2	82.1	81.9	81.8	81.6	81.5	75
76	83.8	83.7	83.5	83.4	83.2	83.1	83.0	82.8	82.7	82.6	82.4	82.3	82.2	82.0	76
77	84.2	84.1	84.0	83.8	83.7	83.6	83.5	83.3	83.2	83.1	83.0	82.8	82.7	82.6	77
78	84.7	84.5	84.4	84.3	84.2	84.1	84.0	83.8	83.7	83.6	83.5	83.4	83.2	83.1	78
79	85.1	85.0	84.9	84.8	84.7	84.6	84.5	84.3	84.2	84.1	84.0	83.9	83.8	83.7	79
80	85.5	85.4	85.3	85.2	85.1	85.0	84.9	84.8	84.7	84.6	84.5	84.5	84.4	84.3	80

TABLE C

A ± B = 60' 62'		-64' -66'		-68' -70'		A & B CORRECTION				80' 82'		-84' 86'		-88' -90' = A ± B	
						72'	74'	76'	78'						
Lat.	°		°		°		AZIMUTHS				°		°		Lat.
68	77.3	76.9	76.5	76.1	75.7	75.3	74.9	74.5	74.1	73.7	73.3	72.9	72.5	72.1	68
69	77.9	77.5	77.1	76.7	76.3	75.9	75.5	75.2	74.8	74.4	74.0	73.6	73.3	72.9	69
70	78.4	78.0	77.7	77.3	76.9	76.5	76.2	75.8	75.4	75.1	74.7	74.3	74.0	73.6	70
71	79.0	78.6	78.2	77.9	77.5	77.2	76.8	76.5	76.1	75.8	75.4	75.1	74.7	74.4	71
72	79.5	79.2	78.8	78.5	78.1	77.8	77.5	77.1	76.8	76.5	76.1	75.8	75.5	75.1	72
73	80.1	79.7	79.4	79.1	78.8	78.4	78.1	77.8	77.5	77.2	76.8	76.5	76.2	75.9	73
74	80.6	80.3	80.0	79.7	79.4	79.1	78.8	78.5	78.2	77.9	77.6	77.3	77.0	76.7	74
75	81.2	80.9	80.6	80.3	80.0	79.7	79.4	79.2	78.9	78.6	78.3	78.0	77.7	77.5	75
76	81.8	81.5	81.2	80.9	80.7	80.4	80.1	79.9	79.6	79.3	79.0	78.8	78.5	78.3	76
77	82.3	82.1	81.8	81.6	81.3	81.1	80.8	80.6	80.3	80.1	79.8	79.6	79.3	79.1	77
78	82.9	82.7	82.4	82.2	82.0	81.7	81.5	81.3	81.0	80.8	80.6	80.3	80.1	79.9	78
79	83.5	83.3	83.0	82.8	82.6	82.4	82.2	82.0	81.8	81.5	81.3	81.1	80.9	80.7	79
80	84.1	83.9	83.7	83.5	83.3	83.1	82.9	82.7	82.5	82.3	82.1	81.9	81.7	81.5	80

TABLE C

A ± B = 90' 92'		-94' -96'		-98' -100'		A & B CORRECTION				102' 104'		106' 108'		110' 112'		114' 116'		118' 120' = A ± B	
						102'	104'	106'	108'										
Lat.	°		°		°		AZIMUTHS				°		°		°		°		Lat.
68	71.4	71.0	70.6	70.2	69.8	69.5	69.1	68.7	68.3	68.0	67.6	67.2	66.9	66.5	66.2	65.8	65.4	65.0	68
69	72.1	71.8	71.4	71.0	70.6	70.3	69.9	69.5	69.2	68.9	68.5	68.1	67.8	67.4	67.1	66.7	66.3	65.9	69
70	72.9	72.5	72.2	71.8	71.5	71.1	70.8	70.4	70.1	69.7	69.4	69.0	68.7	68.4	68.0	67.7	67.3	66.9	70
71	73.7	73.3	73.0	72.6	72.3	72.0	71.6	71.3	71.0	70.6	70.3	70.0	69.6	69.3	69.0	68.7	68.3	67.9	71
72	74.5	74.1	73.8	73.5	73.2	72.8	72.5	72.2	71.9	71.5	71.2	70.9	70.6	70.3	70.0	69.7	69.3	68.9	72
73	75.3	74.9	74.6	74.3	74.0	73.7	73.4	73.1	72.8	72.5	72.2	71.9	71.6	71.3	71.0	70.7	70.3	69.9	73
74	76.1	75.8	75.5	75.2	74.9	74.6	74.3	74.0	73.7	73.4	73.1	72.8	72.6	72.3	72.0	71.7	71.3	70.9	74
75	76.9	76.6	76.3	76.0	75.8	75.5	75.2	74.9	74.7	74.4	74.1	73.8	73.6	73.3	73.0	72.7	72.3	71.9	75
76	77.7	77.5	77.2	76.9	76.7	76.4	76.1	75.9	75.6	75.4	75.1	74.8	74.6	74.3	74.1	73.8	73.4	73.0	76
77	78.5	78.3	78.1	77.8	77.6	77.3	77.1	76.8	76.6	76.4	76.1	75.9	75.6	75.4	75.1	74.9	74.5	74.1	77
78	79.4	79.2	78.9	78.7	78.5	78.3	78.0	77.8	77.6	77.4	77.1	76.9	76.7	76.4	76.2	76.0	75.6	75.2	78
79	80.3	80.0	79.8	79.6	79.4	79.2	79.0	78.8	78.6	78.4	78.1	77.9	77.7	77.5	77.3	77.1	76.7	76.3	79
80	81.1	80.9	80.7	80.5	80.3	80.1	80.0	79.8	79.6	79.4	79.2	79.0	78.8	78.6	78.4	78.2	77.8	77.4	80

C

TABLE C

A ± B = 1 20' 1 24'		1 28' 1 32'		1 36' 1 40'		A & B CORRECTION				1 60' 1 64'		1 68' 1 72'		1 76' 1 80' = A ± B	
						1 44'	1 48'	1 52'	1 56'						
Lat. °	°	°	°	°	°	AZIMUTHS				°	°	°	°	°	Lat. °
68	65.8	65.1	64.4	63.7	63.0	62.3	61.7	61.0	60.3	59.7	59.1	58.4	57.8	57.2	68
69	66.7	66.0	65.4	64.7	64.0	63.4	62.7	62.1	61.4	60.8	60.2	59.6	59.0	58.4	69
70	67.7	67.0	66.4	65.7	65.0	64.4	63.8	63.2	62.5	61.9	61.3	60.7	60.1	59.5	70
71	68.7	68.0	67.4	66.7	66.1	65.5	64.9	64.3	63.7	63.1	62.5	61.9	61.3	60.7	71
72	69.7	69.0	68.4	67.8	67.2	66.6	66.0	65.4	64.9	64.3	63.7	63.1	62.6	62.0	72
73	70.7	70.1	69.5	68.9	68.3	67.7	67.2	66.6	66.0	65.5	64.9	64.4	63.8	63.3	73
74	71.7	71.1	70.6	70.0	69.5	68.9	68.4	67.8	67.2	66.7	66.2	65.7	65.2	64.6	74
75	72.7	72.2	71.7	71.1	70.6	70.1	69.6	69.0	68.5	68.0	67.5	67.0	66.5	66.0	75
76	73.8	73.3	72.8	72.3	71.8	71.3	70.8	70.3	69.8	69.3	68.8	68.4	67.9	67.4	76
77	74.9	74.4	73.9	73.5	73.0	72.5	72.0	71.6	71.1	70.7	70.2	69.8	69.3	68.8	77
78	76.0	75.5	75.1	74.7	74.2	73.8	73.3	72.9	72.5	72.0	71.6	71.2	70.7	70.3	78
79	77.1	76.7	76.3	75.9	75.5	75.1	74.6	74.2	73.8	73.4	73.0	72.6	72.2	71.8	79
80	78.2	77.9	77.5	77.1	76.7	76.4	75.9	75.6	75.2	74.8	74.5	74.1	73.7	73.4	80

TABLE C

A ± B = 1 80' 1 84'		1 88' 1 92'		1 96' 2 00'		A & B CORRECTION				2 20' 2 24'		2 28' 2 32'		2 36' 2 40' = A ± B	
						2 04'	2 08'	2 12'	2 16'						
Lat. °	°	°	°	°	°	AZIMUTHS				°	°	°	°	°	Lat. °
68	56.0	55.4	54.8	54.3	53.7	53.2	52.6	52.1	51.5	51.0	50.5	50.0	49.5	49.0	68
69	57.2	56.6	56.0	55.5	54.9	54.4	53.8	53.3	52.8	52.2	51.8	51.3	50.8	50.3	69
70	58.4	57.8	57.2	56.7	56.2	55.6	55.1	54.6	54.0	53.5	53.0	52.6	52.1	51.6	70
71	59.6	59.1	58.5	58.0	57.5	56.9	56.4	55.9	55.4	54.9	54.4	53.9	53.4	52.9	71
72	60.9	60.4	59.8	59.3	58.8	58.3	57.8	57.3	56.8	56.3	55.8	55.3	54.8	54.4	72
73	62.2	61.7	61.2	60.7	60.2	59.7	59.2	58.7	58.2	57.7	57.3	56.8	56.3	55.9	73
74	63.6	63.1	62.6	62.1	61.6	61.1	60.6	60.2	59.7	59.2	58.8	58.3	57.9	57.4	74
75	65.0	64.5	64.0	63.6	63.1	62.6	62.2	61.7	61.2	60.8	60.3	59.9	59.5	59.0	75
76	66.5	66.0	65.6	65.1	64.6	64.2	63.7	63.3	62.8	62.4	62.0	61.6	61.1	60.7	76
77	68.0	67.5	67.1	66.6	66.2	65.8	65.4	64.9	64.5	64.1	63.7	63.2	62.8	62.5	77
78	69.5	69.1	68.7	68.2	67.8	67.4	67.0	66.6	66.2	65.8	65.4	65.0	64.6	64.3	78
79	71.0	70.7	70.3	69.9	69.5	69.1	68.7	68.4	68.0	67.6	67.2	66.9	66.5	66.1	79
80	72.6	72.3	71.9	71.6	71.2	70.8	70.5	70.1	69.8	69.4	69.1	68.8	68.4	68.1	80

TABLE C

A ± B = 2 40' 2 45'		2 50' 2 55'		2 60' 2 65'		A & B CORRECTION				3 00' 3 10'		3 20' 3 30'		3 40' 3 50' = A ± B	
						2 70'	2 75'	2 80'	2 90'						
Lat. °	°	°	°	°	°	AZIMUTHS				°	°	°	°	°	Lat. °
68	48.0	47.4	46.9	46.3	45.8	45.2	44.7	44.1	43.6	42.6	41.7	40.7	39.8	39.0	68
69	49.3	48.7	48.2	47.6	47.0	46.5	45.9	45.4	44.9	43.9	42.9	42.0	41.1	40.2	69
70	50.5	50.0	49.5	48.9	48.4	47.8	47.3	46.8	46.2	45.2	44.3	43.3	42.4	41.5	70
71	52.0	51.4	50.9	50.3	49.8	49.2	48.8	48.3	47.7	46.7	45.7	44.7	43.8	42.9	71
72	53.4	52.9	52.4	51.8	51.2	50.7	50.2	49.7	49.2	48.2	47.2	46.2	45.3	44.4	72
73	54.9	54.4	53.9	53.3	52.8	52.2	51.7	51.2	50.7	49.7	48.8	47.8	46.9	46.0	73
74	56.5	56.0	55.5	54.9	54.4	53.9	53.4	52.8	52.3	51.4	50.4	49.5	48.6	47.7	74
75	58.1	57.6	57.1	56.6	56.1	55.6	55.1	54.6	54.1	53.1	52.2	51.3	50.4	49.5	75
76	59.8	59.3	58.8	58.3	57.8	57.3	56.8	56.4	55.9	54.9	54.0	53.1	52.3	51.4	76
77	61.6	61.1	60.7	60.2	59.7	59.2	58.7	58.3	57.8	56.9	56.0	55.1	54.3	53.4	77
78	63.5	63.0	62.5	62.1	61.6	61.1	60.7	60.3	59.8	58.9	58.1	57.2	56.4	55.5	78
79	65.4	64.9	64.5	64.1	63.6	63.2	62.7	62.3	61.9	61.0	60.2	59.4	58.6	57.8	79
80	67.4	67.0	66.6	66.1	65.7	65.3	64.9	64.5	64.1	63.3	62.5	61.7	60.9	60.2	80

C

TABLE C

A ± B = 3 50' 3 60'			3 70' 3 80'		3 90' 4 00'		A & B CORRECTION				4 50' 4 60'		4 70' 4 80'		4 90' 5 00' = A ± B		
							4 10' 4 20'	4 30' 4 40'									
Lat. °	°	°	°	°	°	°	AZIMUTHS				°	°	°	°	°	Lat. °	
68	37.3	36.6	35.8	35.1	34.4	33.7	33.1	32.4	31.8	31.2	30.7	30.1	29.6	29.1	28.6	28.1	68
69	38.6	37.8	37.0	36.3	35.6	34.9	34.2	33.6	32.9	32.4	31.8	31.2	30.7	30.2	29.7	29.2	69
70	39.9	39.1	38.3	37.6	36.8	36.2	35.5	34.8	34.2	33.6	33.0	32.4	31.8	31.3	30.8	30.3	70
71	41.3	40.5	39.8	38.9	38.2	37.5	36.8	36.2	35.5	34.9	34.3	33.7	33.2	32.6	32.1	31.5	71
72	42.7	41.9	41.2	40.4	39.7	38.9	38.3	37.6	36.9	36.3	35.7	35.1	34.5	33.9	33.4	32.9	72
73	44.3	43.4	42.7	41.9	41.2	40.5	39.8	39.2	38.5	37.8	37.2	36.6	36.0	35.5	34.9	34.4	73
74	46.0	45.2	44.4	43.7	42.9	42.2	41.5	40.8	40.1	39.5	38.9	38.3	37.7	37.1	36.5	35.9	74
75	47.8	47.0	46.2	45.5	44.8	44.0	43.3	42.6	41.9	41.3	40.6	40.0	39.4	38.8	38.2	37.7	75
76	49.8	48.9	48.2	47.4	46.7	45.9	45.2	44.6	43.9	43.2	42.6	41.9	41.3	40.7	40.1	39.6	76
77	51.8	51.0	50.2	49.5	48.7	48.0	47.3	46.6	45.9	45.3	44.6	44.0	43.4	42.8	42.2	41.6	77
78	53.9	53.2	52.4	51.7	50.9	50.2	49.5	48.9	48.2	47.6	46.9	46.3	45.7	45.1	44.5	43.9	78
79	56.3	55.5	54.8	54.1	53.3	52.6	51.9	51.3	50.6	49.9	49.3	48.7	48.1	47.5	46.9	46.3	79
80	58.8	58.0	57.3	56.6	55.9	55.2	54.5	53.9	53.2	52.6	52.0	51.4	50.8	50.2	49.6	49.0	80

TABLE C

A ± B = 5 00' 5 20'		5 40' 5 60'		5 80' 6 00'		A & B CORRECTION				7 00' 7 20'		7 40' 7 60'		7 80' 8 00' = A ± B			
						6 20' 6 40'		6 60' 6 80'									
Lat. °	°	°	°	°	°	AZIMUTHS				°	°	°	°	Lat. °			
68	28-1	27-2	26-3	25-5	24-7	24-0	23-3	22-6	22-0	21-4	20-9	20-3	19-8	19-4	18-9	18-5	68
69	29-2	28-2	27-3	26-5	25-7	24-9	24-2	23-5	22-9	22-3	21-7	21-2	20-7	20-2	19-7	19-2	69
70	30-3	29-3	28-4	27-6	26-8	25-9	25-2	24-5	23-9	23-3	22-7	22-1	21-6	21-0	20-5	20-1	70
71	31-5	30-6	29-6	28-7	27-9	27-1	26-3	25-6	24-9	24-3	23-7	23-1	22-5	22-0	21-5	21-0	71
72	32-9	31-9	30-9	30-0	29-1	28-3	27-5	26-8	26-1	25-4	24-8	24-2	23-6	23-1	22-6	22-0	72
73	34-4	33-3	32-3	31-4	30-5	29-7	28-9	28-1	27-4	26-7	26-1	25-4	24-8	24-2	23-7	23-1	73
74	35-9	34-9	33-9	32-9	32-0	31-2	30-3	29-6	28-8	28-1	27-4	26-7	26-1	25-5	25-0	24-4	74
75	37-7	36-6	35-6	34-6	33-7	32-8	31-9	31-1	30-3	29-6	28-9	28-2	27-6	27-0	26-4	25-8	75
76	39-6	38-5	37-4	36-4	35-5	34-6	33-7	32-8	32-1	31-3	30-6	29-8	29-2	28-5	27-9	27-3	76
77	41-6	40-5	39-4	38-4	37-5	36-5	35-6	34-8	33-9	33-2	32-4	31-7	30-9	30-3	29-7	29-0	77
78	43-9	42-8	41-7	40-7	39-7	38-7	37-8	36-9	36-1	35-3	34-5	33-7	33-0	32-3	31-6	31-0	78
79	46-3	45-2	44-1	43-1	42-1	41-1	40-2	39-3	38-4	37-6	36-8	36-1	35-3	34-6	33-9	33-2	79
80	49-0	47-9	46-8	45-8	44-8	43-8	42-9	41-9	41-1	40-3	39-4	38-6	37-9	37-2	36-5	35-8	80

TABLE C

A ± B = 8 00' 8 20'		8 40' 8 60'		8 80' 9 00'		A & B CORRECTION				10 0' 10 3'		10 6' 11 0'		11 5' 12 0' = A ± B	
						9 20' 9 40'		9 60' 9 80'							
Lat. °	°	°	°	°	°	AZIMUTHS				°	°	°	°	Lat. °	
68	18-5 18-0	17-6 17-2	16-9 16-5	16-2 15-9	15-5 15-2	14-9 14-6	14-2 13-6	13-1 12-5						68	
69	19-2 18-8	18-4 18-0	17-6 17-2	16-9 16-5	16-2 15-8	15-5 15-2	14-8 14-2	13-6 13-1						69	
70	20-1 19-6	19-2 18-8	18-4 18-0	17-6 17-2	16-9 16-6	16-3 15-9	15-5 14-9	14-2 13-7						70	
71	21-0 20-5	20-1 19-6	19-2 18-8	18-5 18-1	17-8 17-4	17-1 16-6	16-1 15-6	15-0 14-4						71	
72	22-0 21-5	21-1 20-6	20-2 19-8	19-4 19-0	18-6 18-2	17-9 17-5	17-0 16-4	15-7 15-1						72	
73	23-1 22-6	22-2 21-7	21-2 20-8	20-4 20-0	19-6 19-2	18-9 18-4	17-9 17-3	16-6 15-9						73	
74	24-4 23-9	23-4 22-9	22-4 21-9	21-5 21-1	20-7 20-3	19-9 19-4	18-9 18-3	17-5 16-8						74	
75	25-8 25-2	24-7 24-2	23-7 23-2	22-8 22-3	21-9 21-5	21-1 20-6	20-1 19-4	18-6 17-9						75	
76	27-3 26-7	26-2 25-7	25-2 24-7	24-2 23-7	23-3 22-9	22-5 21-9	21-3 20-6	19-8 19-0						76	
77	29-0 28-4	27-9 27-3	26-8 26-3	25-8 25-3	24-8 24-4	24-0 23-4	22-8 22-0	21-1 20-3						77	
78	31-0 30-4	29-8 29-2	28-7 28-1	27-6 27-1	26-6 26-1	25-7 25-0	24-3 23-6	22-7 21-9						78	
79	33-2 32-5	31-9 31-3	30-8 30-2	29-7 29-1	28-6 28-1	27-7 27-0	26-3 25-5	24-5 23-7						79	
80	35-8 35-1	34-4 33-8	33-2 32-6	32-0 31-5	31-0 30-4	29-9 29-2	28-5 27-6	26-6 25-7						80	

C

TABLE C

TABLE C																								
A ± B = 12 0' 12 5'			13 0' 13 5'			14 0' 14 5'			A & B CORRECTION				19 0' 20 0'		21 0' 22 0'		23 0' 25 0' = A ± B							
									15 0' 16 0'		17 0' 18 0'													
Lat.							AZIMUTHS										Lat.							
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°						
68	12.5	12.1		11.6	11.2		10.8	10.4		10.1	9.5		8.9	8.4		8.0	7.6		7.2	6.9		6.6	6.1	68
69	13.1	12.6		12.1	11.7		11.3	10.9		10.5	9.9		9.4	8.8		8.4	7.9		7.6	7.2		6.9	6.4	69
70	13.7	13.2		12.7	12.2		11.8	11.4		11.0	10.4		9.8	9.2		8.7	8.3		7.9	7.6		7.3	6.7	70
71	14.4	13.8		13.3	12.8		12.4	12.0		11.6	10.9		10.2	9.7		9.2	8.7		8.3	7.9		7.6	7.0	71
72	15.1	14.5		14.0	13.5		13.0	12.6		12.2	11.4		10.8	10.2		9.7	9.2		8.8	8.4		8.0	7.4	72
73	15.9	15.3		14.7	14.2		13.7	13.3		12.8	12.1		11.4	10.8		10.2	9.7		9.3	8.8		8.5	7.8	73
74	16.8	16.2		15.6	15.0		14.5	14.1		13.6	12.8		12.1	11.4		10.8	10.3		9.8	9.4		9.0	8.3	74
75	17.9	17.2		16.6	16.0		15.4	14.9		14.5	13.6		12.8	12.1		11.5	10.9		10.4	10.0		9.6	8.8	75
76	19.0	18.3		17.6	17.0		16.3	15.6		15.4	14.5		13.7	12.9		12.3	11.7		11.1	10.7		10.2	9.4	76
77	20.3	19.6		18.9	18.2		17.6	17.0		16.5	15.5		14.7	13.9		13.2	12.5		11.9	11.4		10.9	10.1	77
78	21.9	21.1		20.3	19.6		19.0	18.4		17.8	16.7		15.8	15.0		14.2	13.5		12.9	12.3		11.9	10.9	78
79	23.7	22.8		22.0	21.2		20.5	19.9		19.7	18.1		17.1	16.2		15.4	14.7		14.0	13.4		12.9	11.8	79
80	25.7	24.7		23.9	23.1		22.4	21.7		21.0	19.8		18.7	17.8		16.9	16.1		15.3	14.7		14.0	13.0	80

TABLE C

A±B=25-0' 27 0'			30 0' 33-0'		36-0 40-0'		A & B CORRECTION				80-0' 100'		150' 200'		400' 800' = A±B		
							45-0' 50-0'	60-0' 70-0'									
Lat.							AZIMUTHS								Lat.		
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	
68	6-1	5-6	5-1	4-6	4-2	3-8	3-4	3-1	2-5	2-2	1-9	1-5	1-0	0-8	0-4	0-2	68
69	6-4	5-9	5-3	4-8	4-4	4-0	3-5	3-2	2-7	2-3	2-0	1-6	1-1	0-8	0-4	0-2	69
70	6-7	6-2	5-6	5-1	4-6	4-2	3-7	3-4	2-8	2-4	2-1	1-7	1-1	0-8	0-4	0-2	70
71	7-0	6-5	5-9	5-3	4-9	4-4	3-9	3-5	2-9	2-5	2-2	1-8	1-2	0-9	0-4	0-2	71
72	7-4	6-8	6-2	5-6	5-1	4-6	4-1	3-7	3-1	2-6	2-3	1-9	1-2	0-9	0-5	0-2	72
73	7-8	7-3	6-5	5-9	5-4	4-9	4-4	3-9	3-3	2-8	2-4	2-0	1-3	1-0	0-5	0-2	73
74	8-3	7-7	6-9	6-3	5-8	5-2	4-6	4-2	3-5	3-0	2-6	2-1	1-4	1-0	0-5	0-3	74
75	8-8	8-1	7-3	6-7	6-1	5-5	4-9	4-4	3-7	3-2	2-8	2-2	1-5	1-1	0-6	0-3	75
76	9-4	8-7	7-8	7-1	6-6	5-9	5-3	4-7	3-9	3-4	3-0	2-4	1-6	1-2	0-6	0-3	76
77	10-1	9-4	8-4	7-7	7-0	6-3	5-6	5-1	4-2	3-6	3-2	2-6	1-7	1-3	0-6	0-3	77
78	10-9	10-1	9-1	8-3	7-6	6-9	6-1	5-5	4-6	3-9	3-4	2-8	1-8	1-4	0-7	0-3	78
79	11-8	11-0	9-9	9-0	8-3	7-5	6-7	6-0	5-0	4-3	3-8	3-0	2-0	1-5	0-7	0-4	79
80	13-0	12-0	10-9	9-9	9-1	8-2	7-3	6-6	5-5	4-7	4-1	3-3	2-2	1-7	0-8	0-4	80

C